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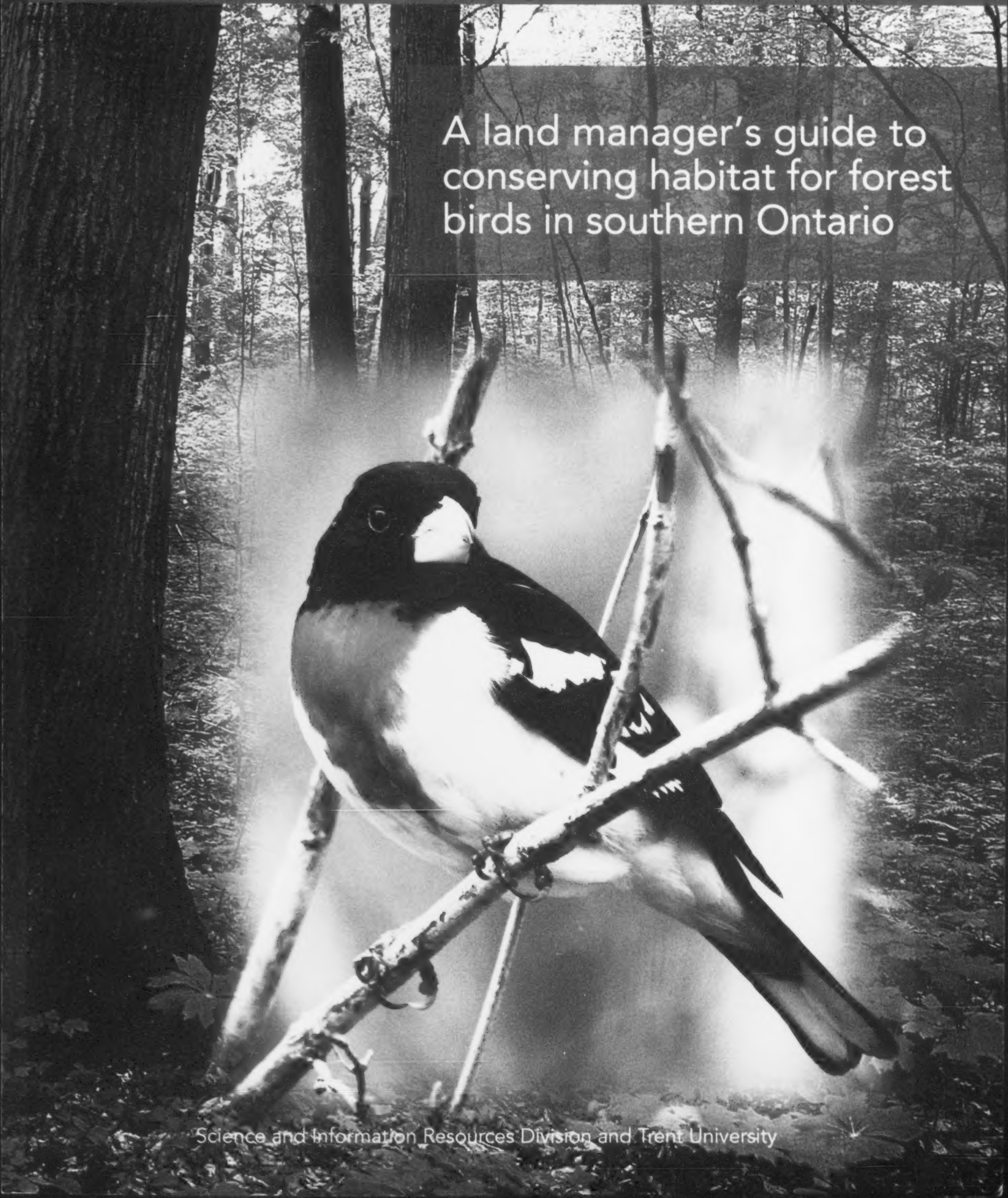
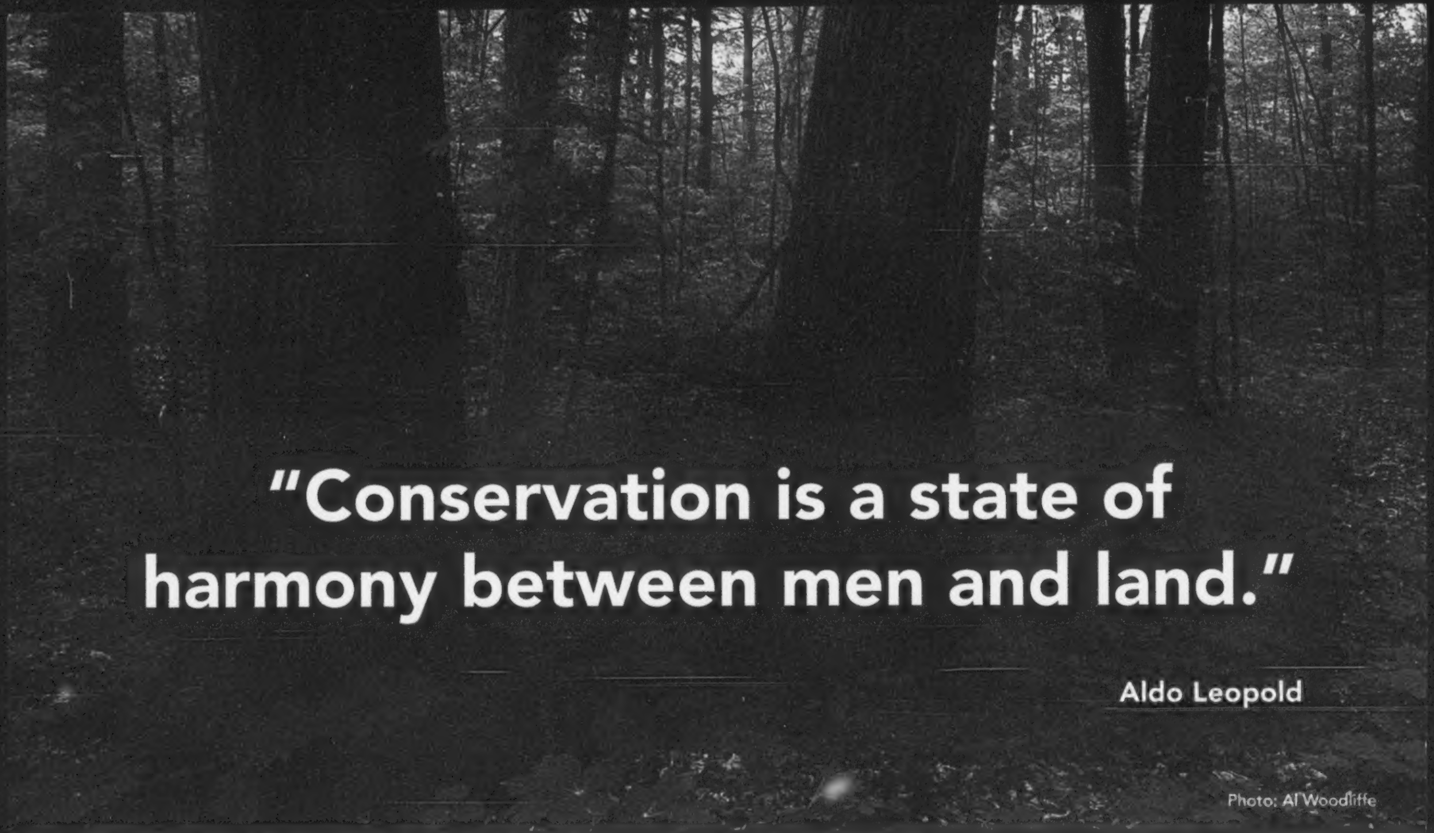


A land manager's guide to conserving habitat for forest birds in southern Ontario

Science and Information Resources Division and Trent University



"Conservation is a state of harmony between men and land."

Aldo Leopold

Photo: Al Woodliffe

Funding for this publication was generously provided by:

- Environment Canada:
  - Habitat Stewardship Program (HSP) for Species At Risk
  - Interdepartmental Recovery Fund
- Ontario Ministry of Natural Resources:
  - Species at Risk Stewardship Fund
  - Southern Science and Information Section
- Eastern Ontario Model Forest

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Artwork: Peter Burke

Acknowledgements: We would also like to acknowledge the hard work and dedication of the following people: Laurie Dool for layout and design, Lyn Thompson for graphics and editing, Trent University staff for administrative assistance, Melissa Strauss and Julia Phillips for writing assistance, our reviewers for ensuring we were on the right track: Jon McCracken — Bird Studies Canada, Erica Nol — Trent University, Brian Batchelor — OMNR Southern Science and Information, Michael Rosen — Tree Canada, and John Enright — Upper Thames River Conservation Authority.

We would also like to extend our thanks to Al Woodliffe, Mark Peck, Greg Lavaty, Lucas Foerster, Brad Woodworth, Doug Tozer, Harold Lee, Scott Gillingwater, Bob McBroom, Scott Reid, Terry Schwan, Jarrid Spice, Kyle Aldinger, Mark Marek, and the Algonquin Park Museum for generously donating their photographs for use in this guide. Without this kind offer we would not have been able to produce such a visually appealing document.

Finally, we would like to thank all the public and private land owners who have allowed us to work in their forests for the past 10 years. It is through this benevolent support that we have been able to develop an Ontario-based understanding of the relationships between birds, woodlands, and their management.

Canada

Ontario

EASTERN ONTARIO MODEL FOREST

Cover Foreground
Rose-breasted Grosbeak — Photo: Jayne Gulbrand

Cover Background
Photo: Al Woodliffe

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A land manager's guide to conserving habitat for forest birds in southern Ontario

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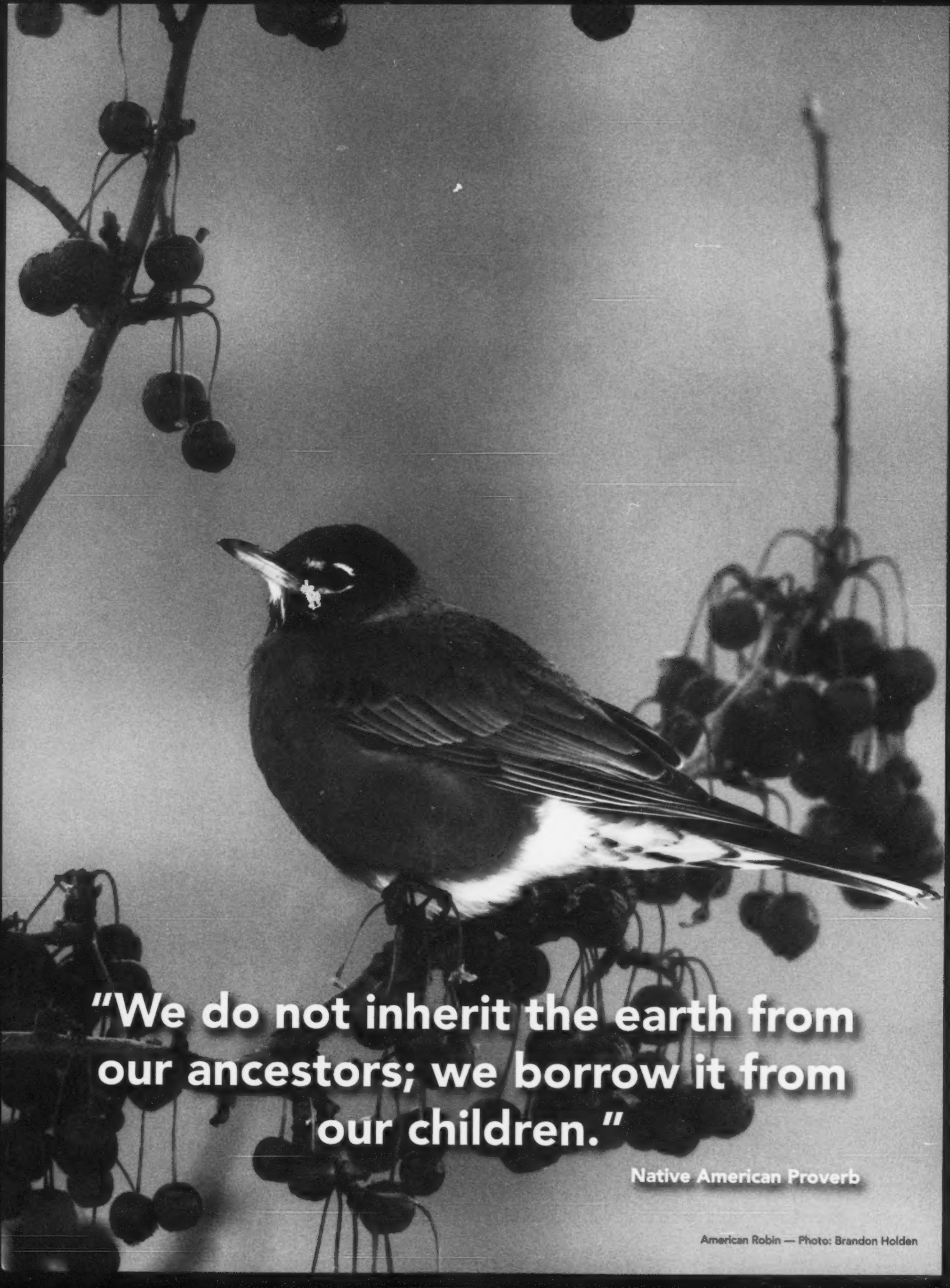
Photo: OMNR



"We do not inherit the earth from our ancestors; we borrow it from our children."

Native American Proverb

American Robin — Photo: Brandon Holden

Male Scarlet Tanangei — Photo: Jeff Nadler

PREFACE

Forests are important for our communities, socially, economically, and ecologically. They maintain clean air and water, provide habitat for thousands of plants and animals, present recreational opportunities, provide income, and contribute to human health and general well being. In southern Ontario, the amount of forest has been dramatically reduced from what it was before European settlement in the early nineteenth century. Today, ensuring the quality and *ecological integrity* of those remaining woodlands is vital. Healthy forests continue to provide natural goods and services while maintaining *biodiversity*. Individual landowners are stewards over much of these remaining woodlands. Though many recognize the value of ensuring long-term health and ecological function, how to accomplish this is often unclear. For example, landowners of forests with economically valuable mature trees may be interested in harvesting, but are uncertain of the associated effects on wildlife and overall forest health. Some may wish to identify the most appropriate harvesting method to meet their management goals. Others may wish to employ management techniques that can benefit wildlife, or preserve wildlife areas. Finally, some landowners may want to know how their woodlot contributes to biodiversity conservation at a larger, landscape scale. This guide is designed to address these questions and provide landowners with information on the habitat requirements of local forest bird species, and the effects of different land management strategies on their populations. A clever woodlot owner has the awareness and knowledge to effectively manage his or her forests for profit and still preserve diverse and healthy forests for future generations.

Although the forests of southern Ontario provide habitat for a variety of organisms including plants, invertebrates, reptiles, amphibians, and small mammals (some of which may be sensitive to disturbances associated with timber harvesting), we have chosen to focus this discussion on forest birds. Birds are one of the most visible wildlife groups, comprising hundreds of different species of extraordinary variety from hummingbirds to eagles. Each species is unique in appearance, habits, and habitat. Some occur in huge numbers while others are sparse; some are sedentary, preferring to spend their entire lives within a few hectares, while others undertake extraordinary annual migrations. Birds are an obvious and diverse component of our forest ecosystem and among one of the most valued and appreciated components of our biodiversity.

Land birds in particular, provide billions of dollars in *ecosystem services* (natural processes that benefit humans) as consumers of pest insects, pollinators, dispersers, and predators of native seeds. They help maintain the same ecosystems that support human life. Many forest birds are sensitive to the structure, composition, and configuration of forests and are good indicators of general forest health. Because birds are valuable to humans in a multitude of ways, current declines in some populations are cause for concern. As wildlife habitat is directly affected by how humans use the land, we all have a responsibility for not simply preventing extinctions, but in maintaining healthy populations of species that are still common.

Skunk cabbage in swamp
Photo: Robert McCaw

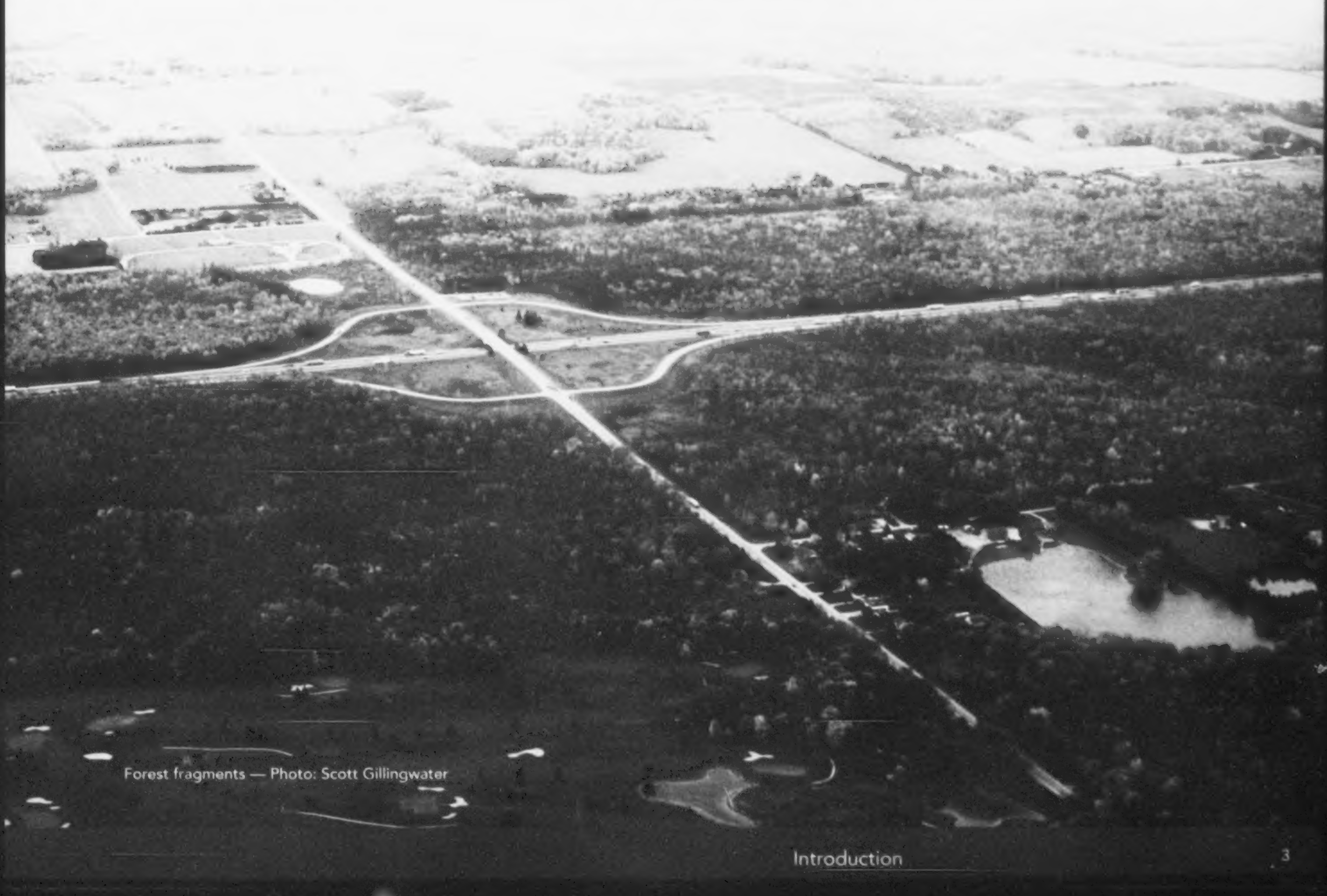
Photo: Harold Lee

> "The oldest task in human history: to live on a piece of land without spoiling it."
>
> **Aldo Leopold**

Photo: Algonquin Museum

INTRODUCTION

Prior to European settlement, forests spread nearly continuously across eastern North America and consisted of a patchwork of large tracts of mature forests interspersed with patches of forest at different ages or successional stages. These forests were dynamic environments which depended on frequent small scale and infrequent large scale disturbances for regeneration, such as: ice storms, windstorms, insects, disease, and fire. These natural disturbances worked to maintain a variety of forest stand structures and ages across the landscape. Where large-scale forest fires and wind storms periodically destroyed huge patches of forest, they created big openings to be regenerated by succession; starting with the growth of sun-loving fast growing plants (such as poplars or grasses) and progressing slowly over many decades toward trees tolerant of shade (see *Forest Succession — Part 1* page 4). From the mid 1700s to early 1900s much of the forest of southern Ontario was cleared by settlers for agriculture, roads, and town development. Early practices such as the use of fire, grazing by cattle and other livestock in the woodlands, and the harvesting of the most valuable trees had an effect on the remaining woodlands. Later in the 20th century, forest fire suppression, devastating exotic tree diseases (e.g., chestnut blight, Dutch elm disease), and the continued use of heavy partial harvesting methods further changed the face of the landscape.



Forest fragments — Photo: Scott Gillingwater

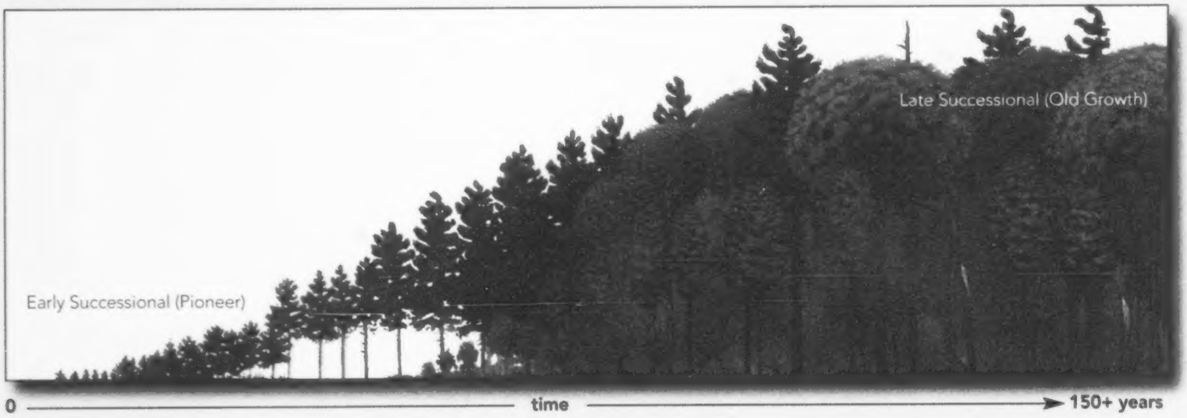
Beech, maple forest — Photo: Al Woodliffe

Forest Succession — Part 1

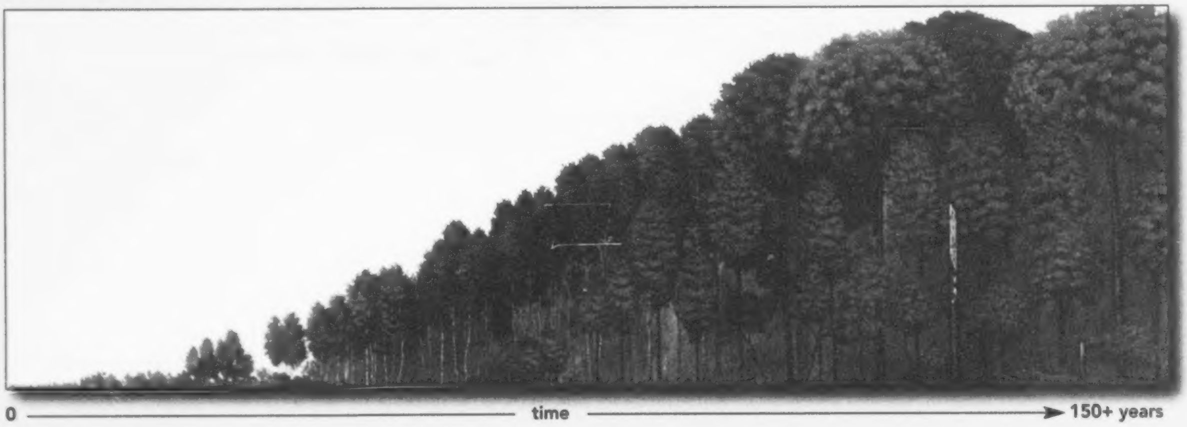
Change is constant on the land. Nature has a basic progression of plant and animal communities. As a field matures to a forest, or goes through the process of succession, there are a series of changes in species composition of plant and wildlife communities. Some species prefer young forests, some prefer older forests, and others require different successional stages at various times in their life (see *Bird Response to Forest Management Practices* pages 50 to 53). Depending on the harvesting techniques used, you will create or maintain different successional stages of forest, which favour different groups of birds. From a songbird perspective, the "best" approach to management may depend on availability of habitat nearby or the sensitivity of species in the area. By retaining a variety of ages and successional stages on the landscape we can ensure a healthy and diverse wildlife community across southern Ontario.

Succession is one of the most important concepts in natural resource management. Nature continually changes. Whether you do something or nothing, your land will change over time. It is critical to understand natural changes when using managed systems. Disturbances occur from natural causes such as wind, fire, and pest infestation. Disturbances can also be the result of human activities such as timber harvesting or forest management. These disturbances represent an alteration in the course of succession. With forest management, the manipulation of succession is intentional, and proceeds with a goal in mind.

Conifer Plantation Succeeding to Natural Mixed Hardwood



Natural Deciduous Forest Succession



Artwork: Peter Burke

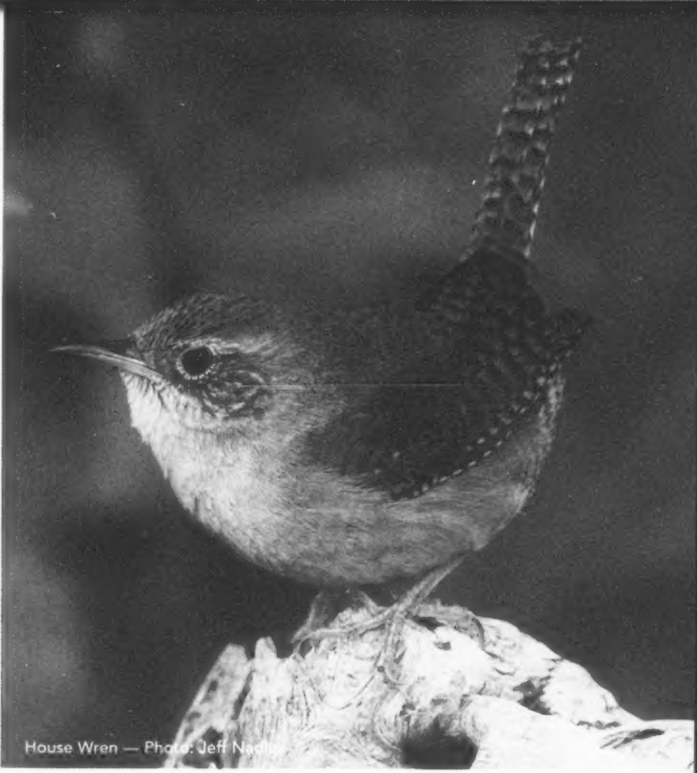
Southern Ontario has a landscape typical of many in eastern North America where agriculture and urban land uses dominate. Land survey reports from the late 1700s consistently estimated that forests covered at least 90 percent (%) of southern Ontario, with more than 70 percent of those being upland forests (i.e., sugar maple). By the 1920s, large-scale land clearing by European settlers converted much of the natural landscape to agriculture production, leaving only 10 percent forest cover remaining. Through the 20th century forest cover increased as marginal farmland was abandoned and left to regenerate into secondary forest, or in some cases, replanting with coniferous seedlings occurred to restore forest to the landscape. Currently, forest cover across southern Ontario averages about 25 percent, ranging from five percent in Essex County to 48 percent in eastern Ontario.

Today the landscape is a mix of agricultural fields interspersed with scattered remnant woodland patches and urban areas. Not only has forest cover been lost but the structure (age, size, and health of trees) and composition (how many individuals of each species) of the remaining forests has been dramatically altered. Remnant woodlots are much smaller and fragmented (broken into small, isolated patches). Old growth forests that once dominated the landscape have been replaced with second growth forests that due to their young age and management history, lack the diversity and complexity of the pre-settlement landscape. Furthermore, fire suppression efforts have encouraged the spread of some species like red maple at the expense of oak and pine, which in nature are favoured by periodic burning. Woodlot harvesting in combination with a lack of fire, and succession have

Early successional habitat — Photo: Peter Burke

Garlic mustard — Photo: Robert McCaw

Prothonotary Warbler — Photo: Greg Lavaty


House Wren — Photo: Jeff Nadl

facilitated the gradual replacement of trees which do not tolerate shade, or can moderately tolerate shade (*shade intolerant* and *mid-tolerant* tree species like birch and pine) with trees that can tolerate shade (*shade tolerant* tree species like sugar maple and American beech). Exotic diseases (such as chestnut blight and Dutch elm disease), invasive plants (like garlic mustard and European buckthorn), and exotic insects (such as gypsy moth and emerald ash borer) shape the forests of southern Ontario. Even the white-tailed deer, by foraging heavily on woodland trees and shrubs has, and continues to change the structure of woodlands today.

These historical and current driving forces have had a large effect on the nature of the forests that remain on the landscape, and hence the wildlife that depend on these forests for habitat, including forest birds. Birds are important components of biodiversity, the health of their populations serve as a benchmark of the health of our ecosystems (see *The Value of Biodiversity* page 7). Biodiversity is the variety of plants, animals, and other living organisms in all their forms, from the gene and species level up to the ecosystem level. Though forest dependent birds likely suffered declines with the initial transformation of the landscape by Europeans in the 18th and 19th centuries, it was not until the late 1930s that methods were developed to properly count bird populations and allow trends to be documented (see *How do we measure bird populations trends* page 9). It is known that since the 1960s population declines have occurred in many forest bird species. Today many of these continue to decline and have created some conservation concern. In Ontario, some species are considered endangered (Acadian Flycatcher, Prothonotary Warbler), threatened (Hooded Warbler, Red-headed Woodpecker), or of special concern (Cerulean Warbler, Louisiana Waterthrush), because their populations have been dramatically reduced, while other species remain relatively common despite steady population declines (2.2 percent per year Wood Thrush; 1.9 percent per year Rose-breasted Grosbeak (see *Bird Species of Concern* table page 88). Even so, there have been a few species that have responded favourably to human habitat alteration and have increased in population size and/or expanded their ranges, including American Robins and House Wrens. Most species threatened or in decline are Neotropical migrants; species who

Gray tree frog — Photo. Scott Gillingwater

The Value of Biodiversity

With more than six billion people living on this planet, it is no wonder that our environment is rapidly changing and the world's natural resources are under enormous pressure. The human population currently consumes more than its share of Earth's natural resources per year, and humans have already cleared nearly half of the world's natural habitats for their use. An estimated one third of what remains is set to disappear over the next few decades if current trends continue. This not only compromises nature's ability to provide us with an abundant supply of clean air and water, and filter toxins from the environment, but many of the world's species are now vanishing at an unprecedented rate.

This loss of biodiversity is alarming considering our lives are dependent upon an intricate relationship between multitudes of organisms working together to achieve ecological balance and stability. Without biodiversity we would have no oxygen to breathe, no clean water to drink, no fertile soil to grow our crops, no food to eat, indeed no functioning biosphere. Many experts agree that any human goal toward improving environmental sustainability must include actions toward maintaining and protecting biodiversity.

Because our understanding of ecosystems remains incomplete, preserving biodiversity allows us to keep our options alive. We cannot predict the consequences of losing species, because all species in nature are connected. When one species vanishes, others that rely on it are weakened and may become threatened, which can in turn weaken more species. Apart from these practical considerations, each species and ecosystem has its own natural, intrinsic value and should be allowed to continue to exist because it exists today.

It has been suggested that birds are important indicators of biodiversity as they are found almost everywhere on Earth, comprise over 10,000 species, and occupy a diverse array of habitats. Not only are birds relatively easy to survey, but they are sensitive to environmental change. Unfortunately, like other wildlife, bird numbers have been declining worldwide due to habitat destruction and fragmentation. Some estimate that one out of every eight bird species today is globally threatened, and one-fifth of all bird species is at some level of conservation concern. Most alarming is that even some of the most common and widespread species are experiencing rapid declines. Loss of habitat, agriculture, poor logging practices, and the spread of invasive species are the top of the threat list followed by urban sprawl, hunting, changes to natural fire regimes, and human-induced climate change.

When managing for biodiversity you manage for all living organisms in order to conserve the full variety of life. Doing so requires that forest management be anchored in the principles of ecology. Any forest management activity (timber harvest, habitat development, re-vegetation, etc.) should occur within the limits of natural disturbance patterns. Because our native species evolved under these patterns, maintaining or mimicking them as closely as possible offers the best protection against the loss of biodiversity. It is in our best interest to slow or reverse the global loss of biodiversity. By taking an active role in properly managing our remaining natural resources, you will take a small but positive step towards protecting and sustaining biodiversity.

Fairy helmet mushroom — Photo: Robert McCaw

Forest wildflowers — Photo: Al Woodliffe

Southern flying squirrel —
Photo: Ken Elliott

Wood Thrush on nest —
Photo: OMNR

Ruby-throated Hummingbird — Photo: Robert McCaw

spend their winters in the Caribbean, Central and South America, and breed and raise their young in North America during the summer. Many are experiencing declines not only in Ontario, but throughout their range. It is important to address population declines before species become endangered or threatened and conservation efforts become increasingly costly and difficult. Research over the past 20 years has shown that habitat degradation caused by deforestation, urban sprawl, and coastal development on breeding, stopover, and wintering areas has the most influence on migratory bird populations. Yet, forest fragmentation (breaking the forest into smaller, more isolated patches) and harvesting activities have significantly altered the quality of remaining habitat. On breeding grounds (i.e., southern Ontario) these factors can significantly affect density, survival, reproductive success, and population sustainability. As birds play a valuable role in the ecosystem, providing a place where they can live and breed in your forest will help control insects, pollinate plants, and disperse seeds.

Careful management of forests on public and private lands may be our greatest opportunity to reverse population declines. With the help of this guide it is our hope that interested landowners will be able to enhance habitat for birds by implementing favourable land use practices. Now is the time to use the knowledge we have gained to reverse negative trends and ensure that common species remain common.

Passenger Pigeon — Artwork: Peter Burke

***Clear cutting* of the forests is believed to be one of the main contributing factors in the extinction of the passenger pigeon. As forests were cleared and fragmented it became harder for their large colonies to nest together. As well, many of the pigeons' favourite nesting sites, with mast bearing trees, were simply eliminated.**

We should never forget the passenger pigeon. Its fate serves as a lesson for all humanity, in that even the most numerous bird on earth can, both directly (hunting), and indirectly (clear cutting) be wiped out by mankind.

How do we measure bird population trends?

The North American Breeding Bird Survey (BBS) was created in 1996 as a large-scale avian monitoring program to track the status and trends of North American bird populations. Managed as a cooperative effort between the United States Geological Survey's Patuxent Wildlife Research Center and Canadian Wildlife Service's National Wildlife Research Centre, the BBS is an important tool for identifying bird conservation priorities. Following a rigorous protocol, BBS data are collected annually by thousands of volunteers skilled in bird identification. Audio and visual point counts are used to survey breeding bird composition at randomly established roadside routes throughout Canada and the United States. Once analyzed, the data provides an index of bird abundance that can be used to determine population trends of more than 400 bird species.

Migration monitoring stations are also used to track the number of birds migrating along migration flyways each year. Special nets catch birds and allow them to be tagged and counted by species, age, and sex. Some stations have been running since the 1960s, monitoring migrating birds in both the spring and fall. The numbers passing through and information on those banded and released at these stations can be used to track year-to-year changes.

Other programs are run at a mix of scales to track populations (www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@lueps/documents/document/mnr_e001791.pdf). One of these includes the Forest Bird Monitoring Program (FBMP) which began in Ontario in 1987 to provide information on population trends and habitat associations of birds that breed in the *forest interior.* Sites consist of three to five stations in woodlands where volunteers who are skilled at identifying birds by sight and sound, perform 10 minute surveys, called point counts, twice between late May and early July.

The National Audubon Society's Christmas Bird Count (CBC) represents the longest running wildlife census used to assess the health of bird populations and help guide conservation action. 2009 marked the 109th year citizen scientists annually braved snow, wind, or rain, to take part in the count. Over 2000 localities across Canada, United States, Latin America, and the Caribbean conduct CBCs; 70 are located in Ontario. These observations have combined into a huge database that reflects the distribution and numbers of winter birds over time. The principal objective is to cover a 24 kilometre (km) diameter circle as completely as possible, tallying all the birds encountered, on a single day during a two and a half week period around Christmas. These data are then compiled and submitted to the Audubon Society and Bird Studies Canada.

The Ontario Birds at Risk (OBAR) program was launched in 1994 to work towards the protection and recovery of vulnerable, threatened, endangered and other bird species at risk in Ontario. OBAR is designed to monitor the status of these species and their habitats, and to provide the necessary data to develop management plans for their protection. OBAR is a joint undertaking of Bird Studies Canada and the Ontario Nature, in cooperation with the Canadian Wildlife Service, the Natural Heritage Information Centre, the Ontario Field Ornithologists, the Ontario Ministry of Natural Resources, and the Royal Ontario Museum. A Site Registry serves as the primary means of collecting and maintaining up-to-date information on the distribution of OBAR target species. The database includes information on confirmed, former, probable, and possible breeding locations, as well as sighting records for species that are considered critically endangered. All location data contributed to the site registry program is strictly confidential.

Knowledge of population levels and trends is fundamental to the management and conservation of biodiversity. Yet, measuring thousands of birds on such a large-scale is virtually impossible. None of these methods is completely accurate, but they can reveal general patterns, and together they provide evidence that there are fewer songbirds today than there were 40 years ago.

Researcher removing bird from net — photo: Scott Gillingwater

Swainson's Thrush captured in mist net — Photo: Scott Gillingwater

Researcher conducting audio and visual point count survey — Photo: OMNR

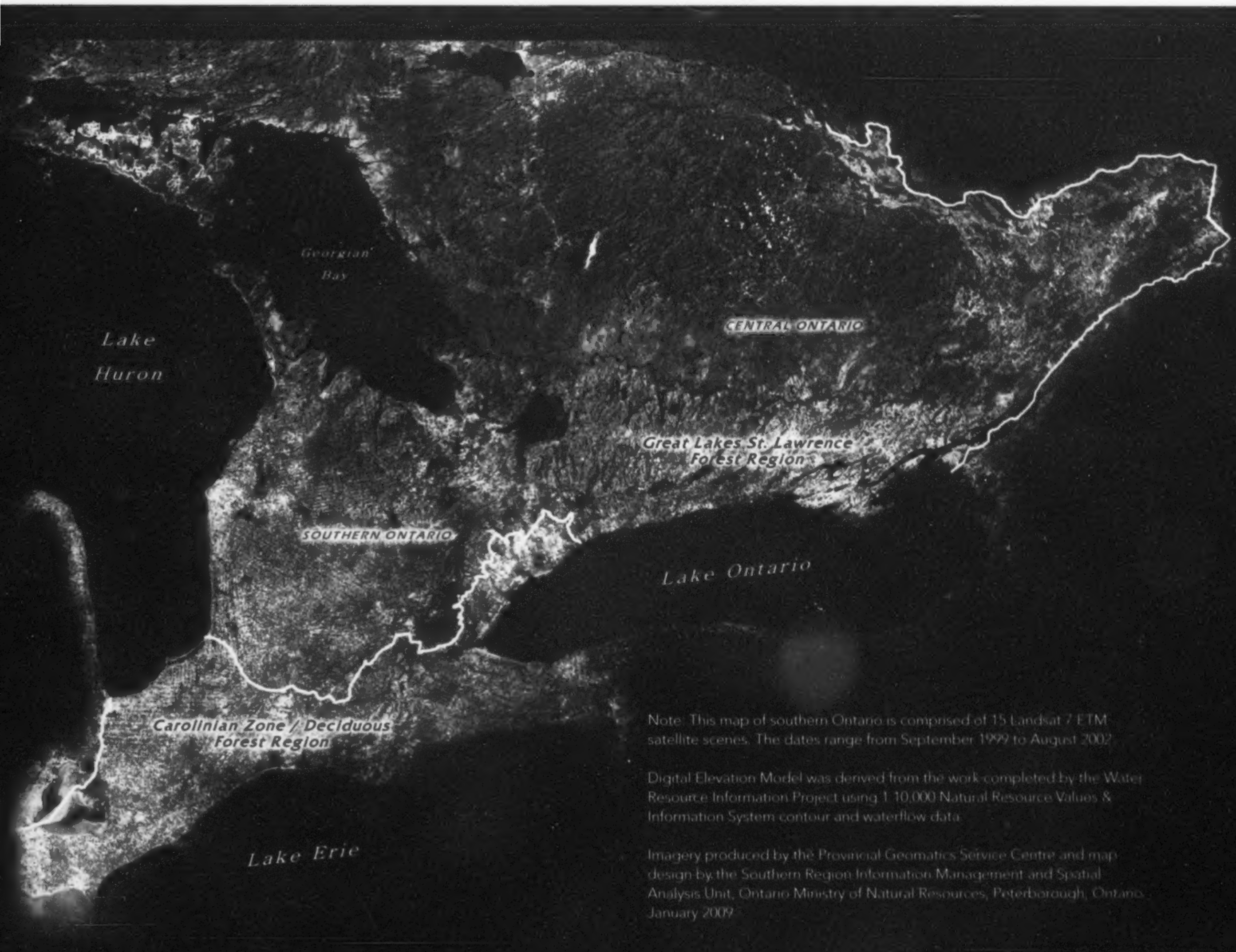
Photo: Lucas Foerster

> "In wildness is the preservation of the world."
>
> Henry David Thoreau

Sugar maples — Photo: Robert McCaw

FORESTS OF SOUTHERN ONTARIO

Southern Ontario is defined as the region south and east of the Canadian Shield. It is composed of two forest regions: the Carolinian or deciduous forest region in the southwest, and the southern portion of the Great Lakes-St. Lawrence forest region in central and eastern Ontario. Variation in bedrock, topography, soils, climate, and disturbance history (fire, wind, and insect) has resulted in a diversity of forest types within and between these regions. As a region, it is densely populated by humans, providing homes for 51 percent of Canada's population.


Georgian Bay
Lake Huron
CENTRAL ONTARIO
Great Lakes St. Lawrence Forest Region
SOUTHERN ONTARIO
Lake Ontario
Carolinian Zone / Deciduous Forest Region
Lake Erie

Note: This map of southern Ontario is comprised of 15 Landsat 7 ETM satellite scenes. The dates range from September 1999 to August 2002.

Digital Elevation Model was derived from the work completed by the Water Resource Information Project using 1:10,000 Natural Resource Values & Information System contour and waterflow data.

Imagery produced by the Provincial Geomatics Service Centre and map design by the Southern Region Information Management and Spatial Analysis Unit, Ontario Ministry of Natural Resources, Peterborough, Ontario. January 2009.

Red trillium — Photo: Robert McCaw

Carolinian Zone / Deciduous Forest Region

Ontario's Carolinian forests are at the northern edge of the deciduous forest region of eastern North America. The zone is known for its relatively mild winters and moist, deep soils. Comprising only one percent of Canada's landmass, the Carolinian zone contains Canada's greatest diversity of flora and fauna. This includes over 70 tree species, many of which are at the northern limit of their range, with species like: tulip tree, sassafras, hackberry, black walnut, and American chestnut. Numerous species of plants, birds, mammals and insects that are considered nationally rare are also found here, including wood poppy, Acadian Flycatcher, and the pine vole.

Great Lakes-St. Lawrence Forest Region

The Great Lakes-St. Lawrence forest is the transition forest between the southern deciduous forest of the Carolinian zone and the predominately coniferous boreal forest region of northern Ontario. Only the southern portion of this forest region, off the Canadian Shield, lies within what is normally called "southern Ontario." Soils are deep and fertile and comprise some of the most agriculturally productive areas in Canada. Forests are dominated by a mix of coniferous and broadleaf deciduous species, including: eastern white pine, red pine, eastern hemlock, white cedar, sugar maple, red maple, American beech, black cherry, white ash, yellow birch, basswood, and red oak. These forests provide habitat for a variety

Wood poppy — Photo: Thomas Whelan

Yellow birch — Photo: Robert McCaw

of other wildlife including American butternut, American ginseng, and the Cerulean Warbler, which are all considered to be provincially rare.

Historically, the structure and composition of forests in southern Ontario was shaped to a large extent by a series of individual tree or multiple tree openings created by small scale disturbances such as windstorms, ice storms, tornadoes, disease, fire, or lightning. In any given year one to three percent of mature trees would be killed or die and create openings. Larger scale wildfires, insect and/or disease infestations changed the structure of the forest when they occurred, but were too infrequent to be the primary driving force. The majority of the historical forest was mature with numerous trees over 200 years old. Most present day forests are *replacement forests* created through a combination of succession and reforestation. A very high proportion of the forest stands are currently in relatively young age classes, and considered *working forests* that are logged on a regular basis. Today, humans are the dominant force on the landscape, altering and shifting natural disturbance regimes. Though much of our management is focused on mimicking patterns in nature, our success at conserving healthy forest environments is challenged in the fragmented, human dominated landscapes such as Southern Ontario.

Canopy gap created by dead tree — Photo: Doug Tozer

Ovenbird — Photo: Marie Read

“A bird doesn’t sing because it has an answer, it sings because it has a song.”

Maya Angelou

Male Chestnut-sided Warbler — Photo: Brandon Holden

FOREST BIRDS IN ONTARIO

In order to develop an understanding of the factors that affect songbirds on their breeding grounds we must first gain some appreciation of their life cycle and basic habitat needs.

Migration

Southern Ontario forests are home to nearly 100 species of breeding birds. One-third (33 percent) of these are resident birds like the Black-capped Chickadee and Downy Woodpecker, seen year round. The rest are migrants that breed and raise their young in Ontario during the summer, and spend the winter in more southern locations. Some migrants travel short distances (southern United States) to their wintering grounds, while others travel up to 10,000 km to the Neotropics (Mexico, Central and South America, and the Caribbean).

Migrant songbirds typically start arriving on the breeding grounds in southern Ontario in early May, though the timing varies by species. Generally, older males will arrive first, then younger males, followed by older females, and finally the young females. These birds will have a few short months to nest—the success of their populations hinging on how many young they will be able to successfully fledge from their nests each year. Depending on the species, each pair will attempt to raise one or two families (*broods*), usually of two to five young. This is no small task for most songbirds breeding in forest fragments of southern Ontario, as they face a myriad of challenges, including nest predation, nest parasitism by Brown-headed Cowbirds (see below), and food limitations, all of which can have a strong impact on their ability to successfully raise their young.

Well-concealed Chestnut-sided Warbler nest in shrub — Photo: OMNR

Despite this long list of challenges, by migrating from one place to another, birds have evolved a way to take advantage of food and shelter that is scarce in certain geographic areas at particular times. Habitats on the wintering grounds (like the Caribbean) offer feeding opportunities that are not available during the winter on the breeding grounds (like southern Ontario) when freezing temperatures eliminate insects and other food resources. Habitats on the breeding grounds provide high insect populations, long days, and breeding opportunities with less competition, compared with the wintering grounds where migrants have to compete with residents and their preferred food sources become scarce. In the end, it pays for migrants to make the effort to relocate north to woodlots in southern Ontario each spring to breed, where they can raise more offspring than if they had remained on their wintering grounds to compete with resident birds breeding there.

Breeding Biology

Each species has a unique nesting strategy. Some, called *cup nesters*, build nests like those of the American Robin, with sticks, leaves, plant fibres, strips of bark, mud, spider webs, or animal hair. These cup nesters will place well concealed nests on the ground, in shrubs or small saplings, or high in the canopy, depending on the species and habitat. Others, called *cavity nesters*, build nests in tree holes. Cavity nesters are divided into two groups: primary cavity nesters, like the Pileated Woodpecker, which dig out their own hole; and secondary cavity nesters, like the Great Crested Flycatcher, which use existing cavities (often made by primary cavity nesters, but include natural tree holes) for their nest. Once a nest is constructed, birds will lay one egg a day until

Pileated Woodpecker cavity — Photo: OMNR

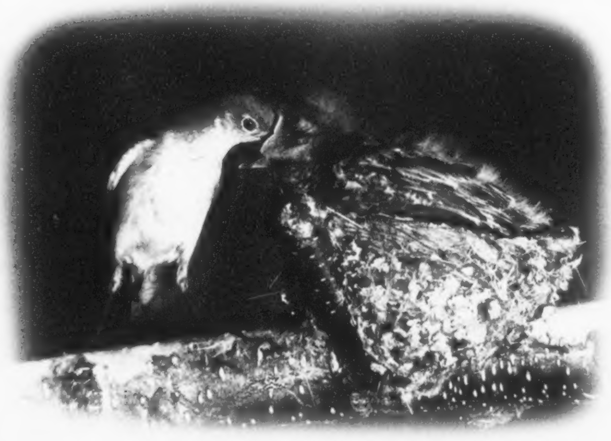
Wood Thrush nestlings — Photo: OMNR

they have a full clutch (three to five eggs for most species, but up to eight eggs for some cavity nesters). For many, the eggs will hatch in approximately 12–14 days, and the young will stay in the nest 10–14 days before they are big and strong enough to leave (*fledge*). Eggs and young birds (*nestlings*) are popular food for many nest predators. On average, a cup nest has less than a 50 percent chance of seeing any young leave the nest, but primary cavity nesters, like woodpeckers, tend to be more successful. Nest predation accounts for most nest failures (80 percent), though some nests may fail because of bad weather, or young may die of starvation. The suite of nest predators includes: small mammals (mice, shrews, and chipmunks), larger mammals, (squirrels, raccoons, cats, opossums, and weasels), avian predators (American Crow or Blue Jay), and snakes. If a nest does get destroyed, adults will attempt to re-nest until they are successful or they run out of time and need to migrate south. Although nest predation is a natural part of evolutionary history, predation levels can be greatly increased by human activities such that these bird populations are no longer sustainable.

In addition to the direct loss of eggs and nestlings to predation, many unsuspecting birds lose out without even knowing it — because of cowbirds. The Brown-headed Cowbird is a *brood parasite*, common to southern Ontario's highly fragmented landscape. Brood parasites never build a nest or raise their own young. Instead, they lay their eggs in other birds' nests, often removing one or two of the host eggs in the process. Female cowbirds are prolific breeders and can lay up to 40 eggs each breeding season. Host parents raise the cowbird young alongside their own; often at the expense of the host's young (see photo below). Cowbird nestlings usually hatch earlier, are faster growing, and more aggressive than host young, outcompeting them for food, resources, and space. As a result, fewer, often less healthy host young, or sometimes no host young fledge from a parasitized nest. This can substantially lower the number of young produced by each pair, especially when some nests may contain two or three cowbird eggs.

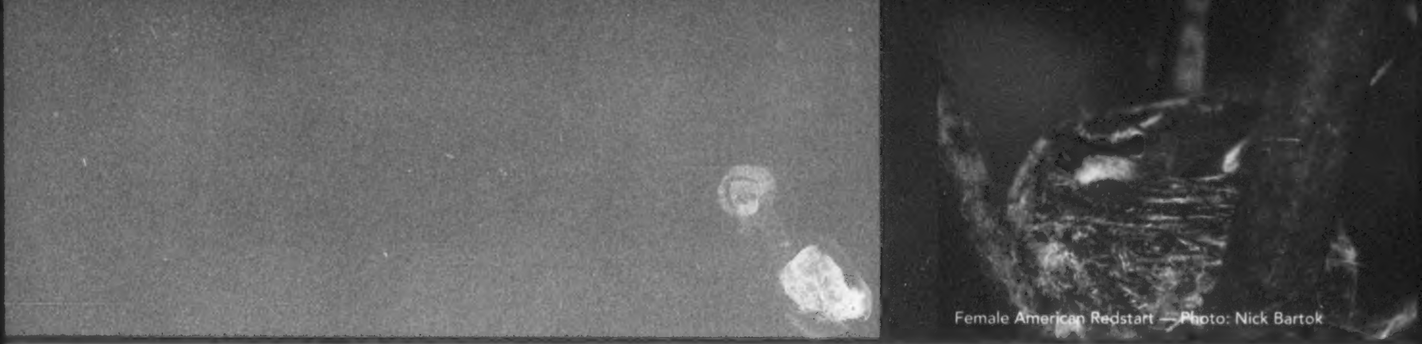
Cowbirds are dependent on open fields, crops, and pasture for foraging on seeds and insects. Prior to European settlement, cowbirds were restricted to the buffalo-grazed and fire-maintained grasslands of the Great Plains of central North America. However, with the clearing of eastern forests for agriculture and settlement in the 1800s, cowbirds were able to expand their range eastward and in the process exposed many new bird species to nest parasitism. Unlike species that developed with cowbirds and learned to reduce their impact, (like removing cowbird eggs from the nest or abandoning parasitized nests), species with no long term exposure to cowbirds have no defence and can be particularly vulnerable. For example, nearly half of all Wood Thrush nests are parasitized in some parts of southern Ontario. This can significantly reduce Wood Thrush productivity to half that of unparasitized nests.

Together nest predation and nest parasitism have the potential to reduce the nesting success for many forest songbirds. This can be especially true in highly fragmented landscapes, where additional food in the form of crops elevates populations of some nest predators (like racoons) and where grass exists for cowbirds



Blue-gray Gnatcatcher host parent feeding Brown-headed Cowbird nestling — Photo: G.K. Peck

Squirrel eating nestling bird — Photo: Bob McBroom



Female American Redstart — Photo: Nick Bartok

to forage on. Yet, these are not the only factors affecting productivity. Food availability within a woodlot can have a substantial influence on the nesting success of forest birds. Habitats with poor food resources will result in reductions in the growth of young, their survival, the number of nesting attempts, and the number of young that survive until they are independent. Food can vary annually due to natural variation in insect populations; but it is also highly dependent on vegetation structure and the landscape features.

For most species, once the young have fledged from the nest, they are dependent on the parents for food and protection for two to three weeks. This is a time when many young die. The first few days, young cannot fly and stay relatively close to the nest site. Thereafter, they move further away, often into more protected areas with dense, low trees and shrubs, and begin to forage for themselves. By the end of the third week they are totally independent.

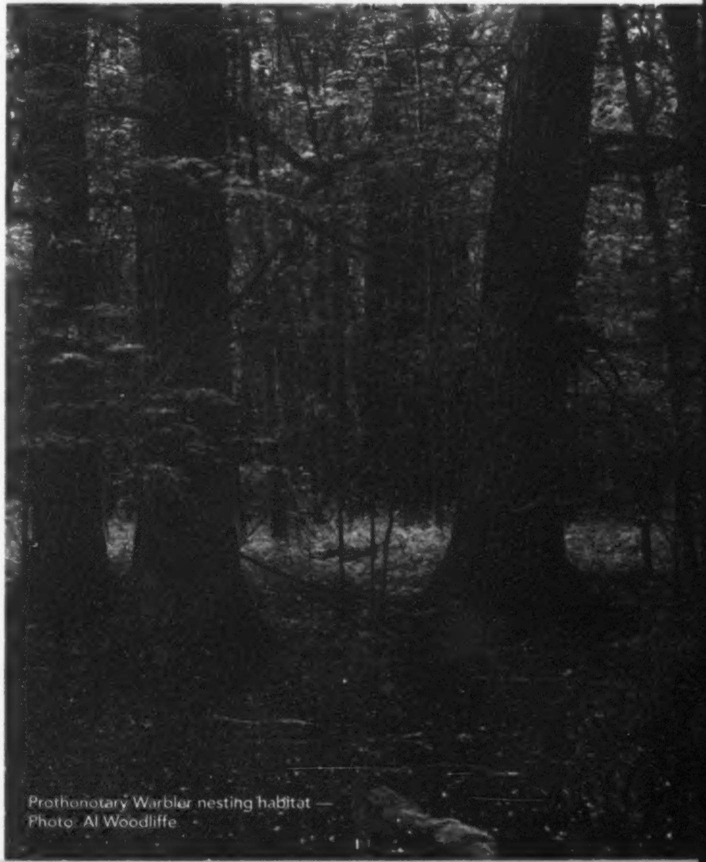
Finally, at the end of the breeding season, in August or September, adults gradually replace all their old feathers with new ones. This process is called *molting*. They also build up fat reserves for their fall migration back to the wintering grounds.

Prothonotary Warbler at nest cavity — Photo: Mark Peck

Habitat Selection

Wildlife needs a place to live. For humans, this place is called *home*, but for wildlife, this place is called *habitat*. Habitat includes food, water, shelter, and space. When all parts blend together an individual not only survives, but thrives. The quality of the habitat for a bird is based on how well it can provide food, water, cover, and nest sites. Not all habitats are equal, and each bird species has a unique set of requirements. Some, *habitat specialists*, are very specific in their requirements, like the Prothonotary Warbler which requires cavities in large, living trees or snags (standing dead trees) in flooded woodlands for its nest site. Other species, like the American Robin, can adapt easily to changes in the environment, and are called *habitat generalists*. This species can nest in the canopy of a large tree in a forest, in the eaves trough of your house, or virtually anywhere in between.

Usually, the more varied the habitat conditions, the greater the variety of wildlife or biodiversity that habitat will support. This diversity is intimately linked to the structure, age, and composition of the forests. *Vertical structure*, an important feature of a habitat, is the extent to which plants are layered within a stand. This arrangement of plant growth forms (trees, vines, shrubs, herbs, etc.) combined with the distribution of trees of different species, age, height, diameter, and crown characteristics determines the vertical structure of the forest.



Prothonotary Warbler nesting habitat — Photo: Al Woodliffe

Maidenhair fern — Photo: OMNR

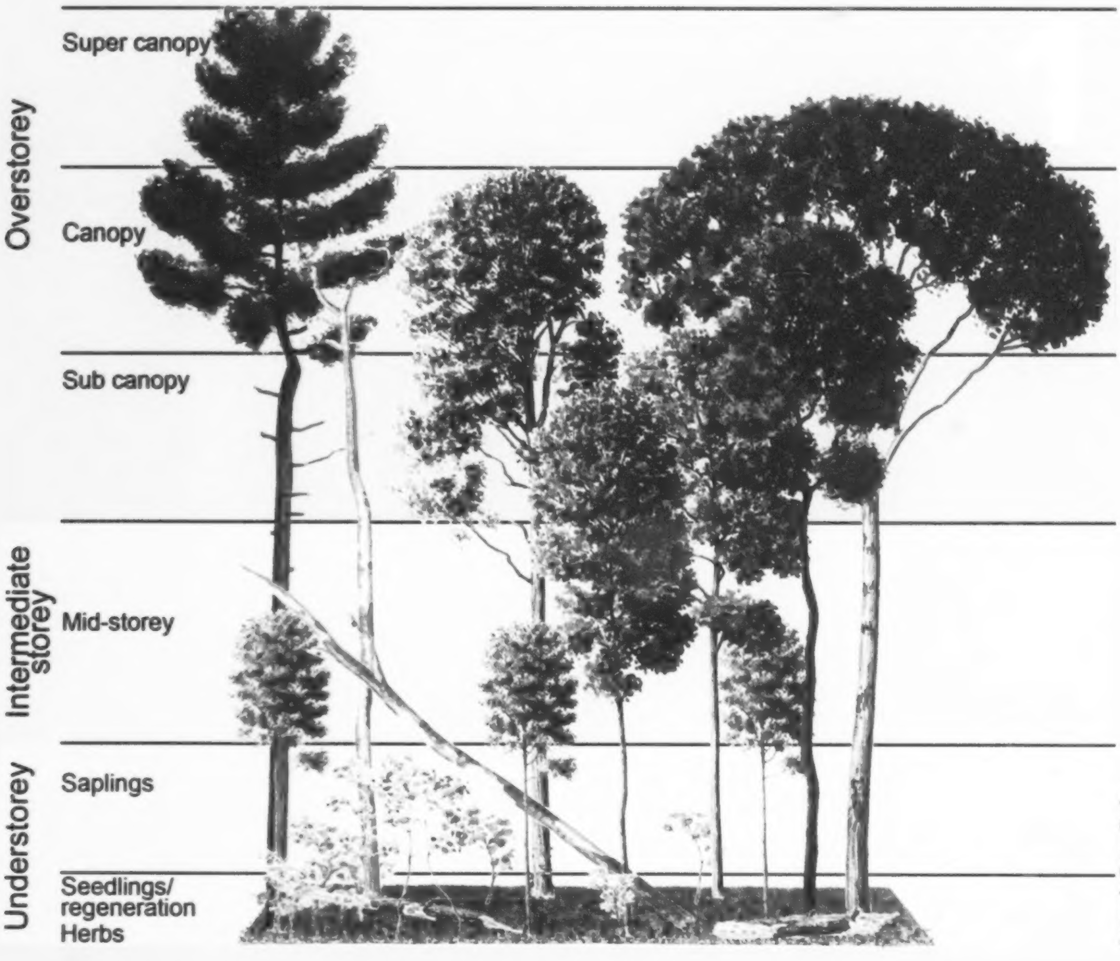
Forest Succession Part II

Nature closely ties forest succession to forest structure and the amount or complexity of vegetation that you find at various heights in the forest, known as vertical structure. The vertical structure of forests differ depending on their stage of succession. The main plant layers include the overstorey (main canopy), the intermediate storey (mid-canopy) and the understorey.

1. **Overstorey (Main Canopy):** includes the natural assemblage of larger tree species. This layer can create a canopy that influences overall light availability and average temperatures at the lower levels. These trees can be sparse or close together to create a tight canopy. Removal of the canopy trees changes the intermediate and understorey environments, and provides an opportunity for saplings to be released from the shade and grow into the canopy. In some forests there is a *supercanopy* layer, of individual trees that jut out above the main canopy, like a tall white pine.

2. **Intermediate (Mid-Canopy):** includes smaller and larger shrubs, smaller species of trees, and young saplings of larger overstorey tree species. These plants may be adapted to softer light and

Main Vegetation Layers of the Forest



Artwork: Peter Burke

cooler temperatures created by the shading effect of the overstorey canopy. Woody perennial plants (trees and shrubs) dominate the intermediate storey.

3. **Understorey:** includes the lowest vegetation layer such as mosses, ferns, grasses, small wildflowers, and other low ground covering herbaceous or woody plants (shrubs and tree seedlings).

Immediately following clear cutting or farmland abandonment, the bare land will begin to support patches of *herbaceous* vegetation such as grasses and forbs. This habitat will be suitable for grassland species like Eastern Meadowlark and Bobolink. As succession advances, woody shrubs, seedlings, and saplings invade the area, providing habitat for species like Gray Catbirds and Eastern Towhees. Early and mid-successional forests may have two layers, an understorey of shrubs and young trees, and an overstorey of canopy trees. Once the overstorey tree canopies become interlocking, the forest floor is typically bare until canopy trees are taller and natural mortality or human intervention creates gaps where light can reach the forest floor. Within late-successional or old growth forests, structural diversity is usually high, there are extensive patches of dense herbaceous ground cover, and understorey of seedlings and shrubs, intermediate layers of saplings and small trees, a lower canopy of small trees, and a primary canopy of mature trees.

Overall, the age structure of forests within our human dominated landscape has shifted towards younger forests, at the expense of species dependent on mature forest conditions. Land managers can use management techniques to encourage old growth features and pockets of high structural diversity. They should make an effort to preserve existing old growth stands and provide for the development of future old growth stands by leaving areas undisturbed or unharvested for 150 years or more. Controlling ungulates, particularly white-tailed deer or grazing cattle, monitoring and controlling invasive plants and human recreational activities may be necessary to protect understorey vegetation and sensitive habitats in some areas.

Regenerating field — Photo: Harold Lee

Male Black-throated Blue Warbler — Photo: Garth McElroy

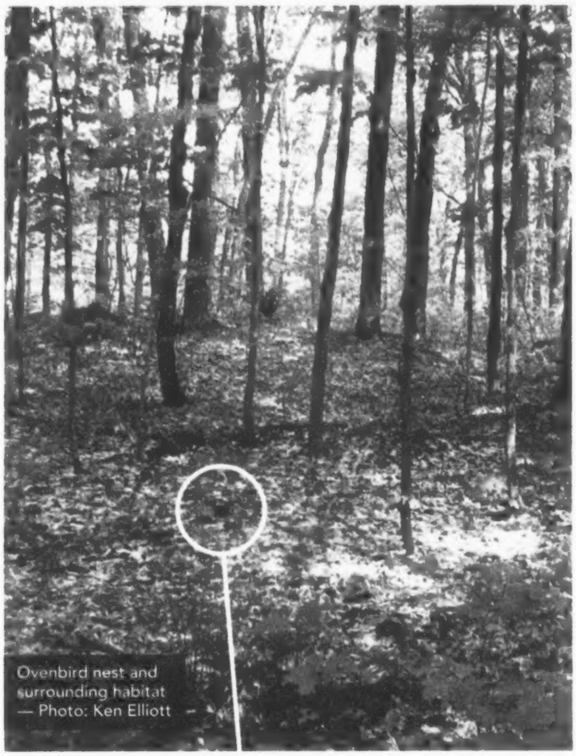
Landbird Migration Stop-Over Areas

Forests provide birds with food, water, and cover, not only during the breeding season but for some, throughout the year, and for others, at critical stages during migration. Stopover habitats are essential to successful bird migrations. Migrating birds need these critical stopover locations in the same way we need gas stations, restaurants, hotels, and rest areas when we take long trips. Strategically located patches of woods, wetlands, and other natural habitats with adequate food and shelter ensure the survival of a species. If development continues to remove these habitats from our landscape, it becomes increasingly difficult for exhausted migrants to find suitable areas to rest and refuel. Large numbers of migrating birds move along the shorelines of the Great Lakes, stopping to rest, feed, and/or wait for inclement weather to pass before attempting to cross open water. Because each species has different habitat requirements, they require a variety of relatively undisturbed habitat types, ranging from open fields to mature forests. In particular, forested habitats within 5 km of the Great Lakes (especially Lake Erie and Lake Ontario) provide roosting areas, cover from predators and foul weather, and food for large numbers of migratory birds. Landowners and managers can help protect important migratory stopover areas by using restoration and silvicultural approaches that maintain forested land, especially along watercourses and in areas where little woodland remains. As a general rule, like breeding birds, managing forests for habitat diversity is good for migrating birds. Diverse, mature forests with shrub and sapling layers will provide a high diversity of edible fruits and nuts in the fall that allow migrants to replenish their resources prior to the next leg of their journey.

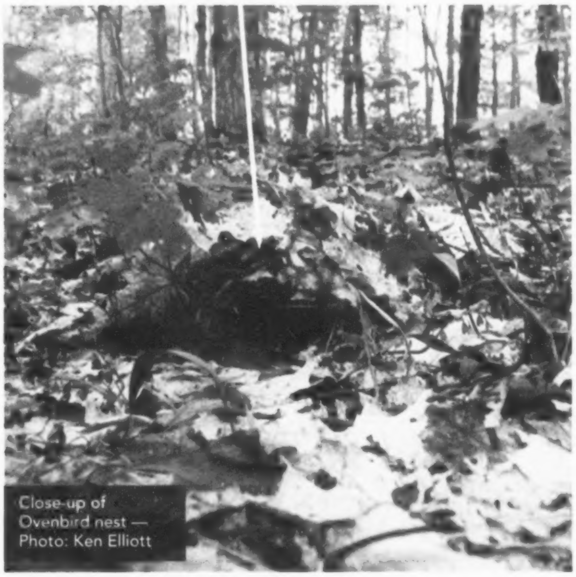
Male Northern Cardinal feeding recently fledged young — Photo: Marie Read

This in turn governs the range of habitats available to different organisms. Generally, forests that have many layers from the ground to the canopy will support a greater array of plant and animal species compared to forests in which the vegetation is concentrated in a single layer. Lack of vegetation structure will have negative effects on species that rely on specific layers of vegetation for food or cover. Territories of different species can overlap horizontally and vertically within the forest.

Suites of species that have similar habitat requirements are often grouped according to a nesting or foraging *guild*. Some birds prefer open, shrubby habitat found in young forests (i.e., early successional guild), whereas others prefer closed canopy forests with large trees and belong to the mature forest. For an individual bird, selecting suitable habitat can have the greatest influence on its ability to survive and reproduce. Faced with a multitude of possible choices in the landscape, how do birds choose the most appropriate habitat? They do this by making a series of choices, first at very large or coarse scales (e.g., all of southern Ontario), then at increasingly finer, smaller scales. For example, an Ovenbird (a small ground nesting bird with bold breast spots, that returns to breed in the woodlots of southern Ontario in the spring), first chooses a forest patch. This may be based on the size of the patch, the surrounding landscape features, and adjacent land uses. Next it will have to choose a territory within that patch. This will be based on the structure of the forest and the availability of food within it. Finally, the Ovenbird will choose a nest site. Ovenbirds nest on the ground and will look for particular vegetation features and structures that may hide the nest from predators and cowbirds.



Ovenbird nest and surrounding habitat — Photo: Ken Elliott



Close-up of Ovenbird nest — Photo: Ken Elliott

The Reproductive Challenge

Although each bird attempts to raise as many young as possible over its lifetime, to maintain a population, births must equal deaths. Each adult, within its lifespan, must replace itself with an offspring of reproductive age. For most songbirds this means a pair must produce one young that survives to the next breeding season. This may not seem difficult over an average life span of two to three years, given that most birds lay three to four eggs per nest, and many can produce more than one successful nest per year (double brooding). However, once you consider rates of nest failure (50–80 percent) and losses due to parasitism (15–50 percent of nests are parasitized and fledge half as many young), the probability of those eggs successfully hatching and the young surviving the winter to return and breed is greatly reduced. As well, once a nestling has left the nest, its survival is often very poor within the first week of life, never mind the additional challenges of migration and over-winter survival!

Male American Redstart — Photo: Garth McElroy

Forest Food Resources

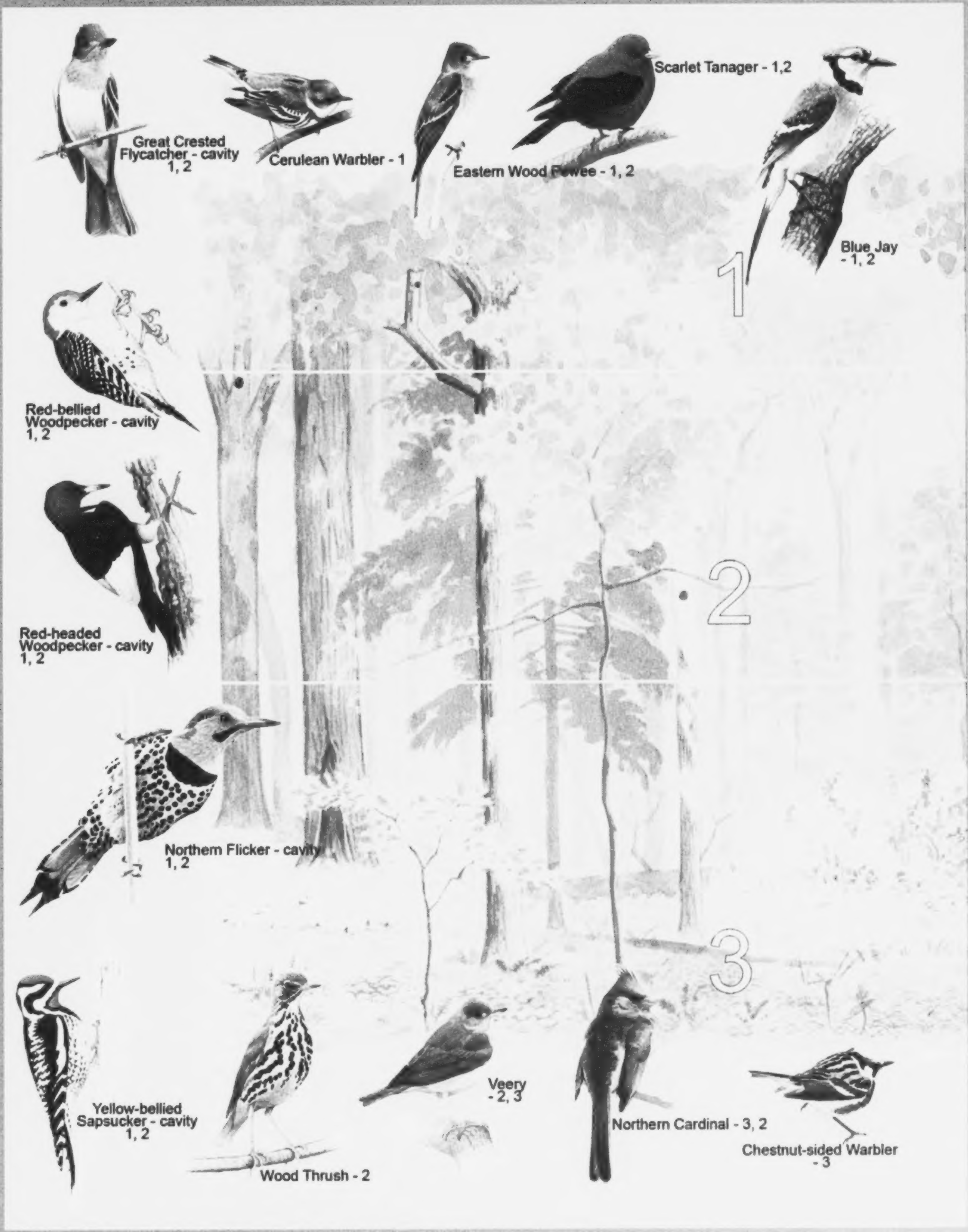
The food available to breeding birds is primarily determined by the composition and structure of the vegetation present. Availability of seeds, fruits and flowers, a direct source of food for many species, is intimately tied to the habitat. Abundance of insects, which serve as a critical food source during the nestling stage, is also determined by vegetation structure, and indirectly links birds with vegetation. Insects provide protein necessary for growth and development of nestlings and fledglings. Caterpillars, in particular, are a major component of the diet of many breeding birds, as they are relatively large and easily captured. Each bird species has a specific foraging strategy to locate and capture insect prey. Foliage gleaners pick caterpillars and aphids off the surface of leaves, whereas bark gleaners pick grubs, spiders, and other insects from the surface and crevices of bark, twigs, and wood. Aerial foragers capture moths, beetles, flies, and ballooning spiders and caterpillars (i.e., insects dangling in the air from strands of silk attached to trees) from the air, and ground feeders primarily search for beetles and ants in the leaf litter on the forest floor.

Vegetation structure is very important to foraging birds and can influence the number of species of birds a habitat supports. The canopy, mid-canopy, shrub, and understorey layers of a forest create different foraging microhabitats (see *Habitat preferences of common forest birds* pages 22–23). Birds like Cerulean Warblers and Scarlet Tanagers forage high in the canopy, whereas other foliage gleaners, like Hooded Warblers and American Redstarts, will forage low in the shrub layer. Native plant diversity further influences available food resources. Each plant species supports a characteristic composition and abundance of insects. Certain bird species may prefer certain tree species over others because prey is more abundant or more easily obtained due to their structure. For instance, foliage gleaners may prefer hardwoods like yellow birch and oak over sugar maple, because sugar maple has lower densities of caterpillars and longer leaf stems that make caterpillars on leaves harder to reach by birds hopping along on branches. The depth of bark crevices also influences prey abundance, and older trees with deeply fissured bark are preferred foraging habitat for species such as the Brown Creeper, which probes the crevices searching for insect prey. Less common species like the Cerulean Warbler tend to be highly selective in habitats used for foraging, while more common species, such as the Red-eyed Vireo, are not as picky about where they forage.

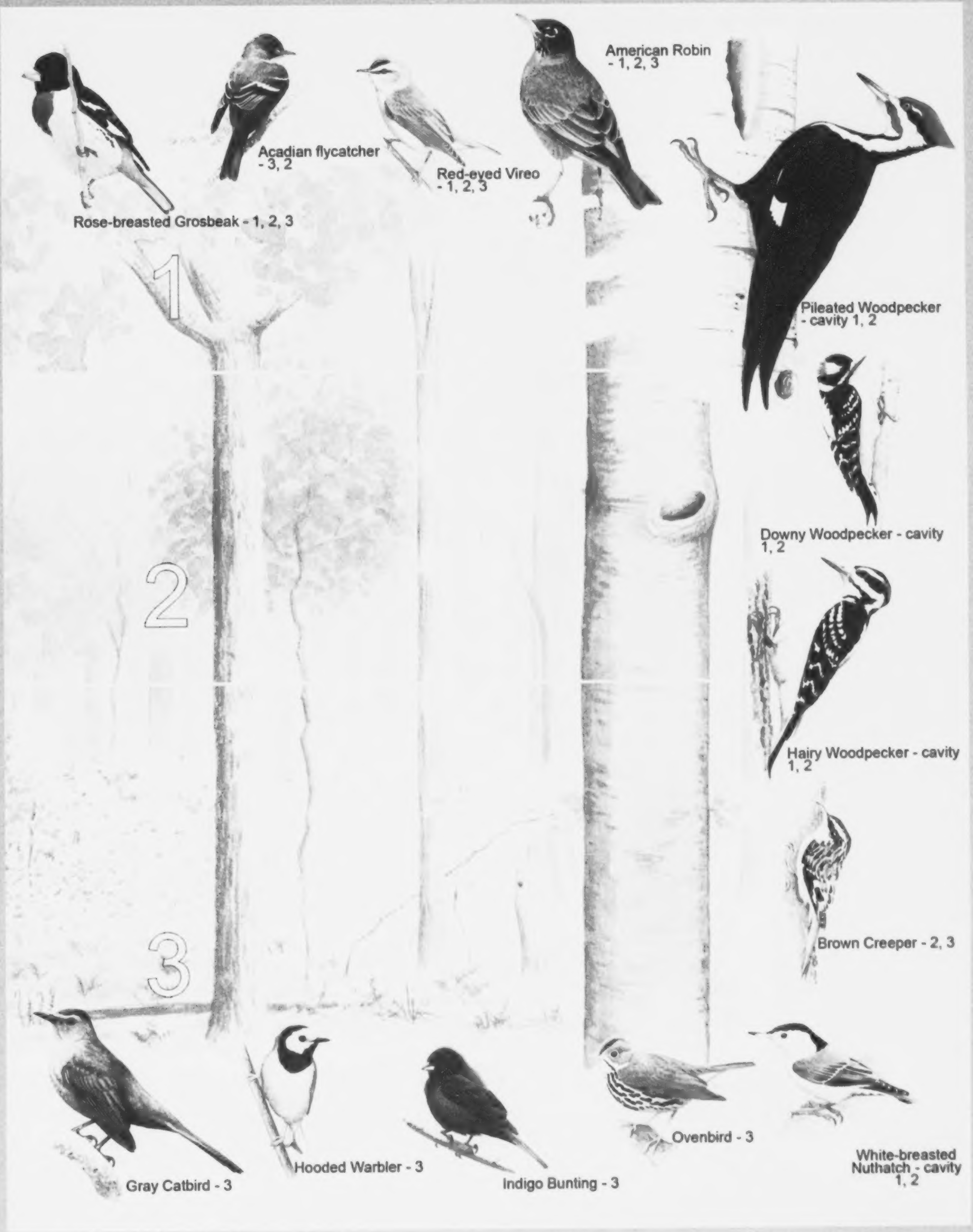
Ultimately, the diversity of microhabitats within a forest will strongly influence the bird species that it supports. Maximizing structural diversity and plant diversity, and retaining specialized habitat features like fallen dead wood, cavity trees, snags, and large trees will cascade up the food chain to increase bird diversity.

Male Cerulean Warbler with caterpillar — Photo: G[illegible] Lav[illegible]

Habitat Preferences of Forest Birds


Great Crested Flycatcher - cavity 1, 2
Cerulean Warbler - 1
Eastern Wood Pewee - 1, 2
Scarlet Tanager - 1,2
Blue Jay - 1, 2
1
Red-bellied Woodpecker - cavity 1, 2
Red-headed Woodpecker - cavity 1, 2
2
Northern Flicker - cavity 1, 2
3
Yellow-bellied Sapsucker - cavity 1, 2
Wood Thrush - 2
Veery - 2, 3
Northern Cardinal - 3, 2
Chestnut-sided Warbler - 3

1- refers to **overstorey** or **main canopy** layer
2- refers to **intermediate storey** or **mid-canopy** layer
3- refers to **understorey** layer (includes the sapling, seedling, regeneration, and herbaceous layer)


Rose-breasted Grosbeak - 1, 2, 3
Acadian flycatcher - 3, 2
Red-eyed Vireo - 1, 2, 3
American Robin - 1, 2, 3
Pileated Woodpecker - cavity 1, 2
1
Downy Woodpecker - cavity 1, 2
2
Hairy Woodpecker - cavity 1, 2
Brown Creeper - 2, 3
3
Gray Catbird - 3
Hooded Warbler - 3
Indigo Bunting - 3
Ovenbird - 3
White-breasted Nuthatch - cavity 1, 2

Artwork: Peter Burke

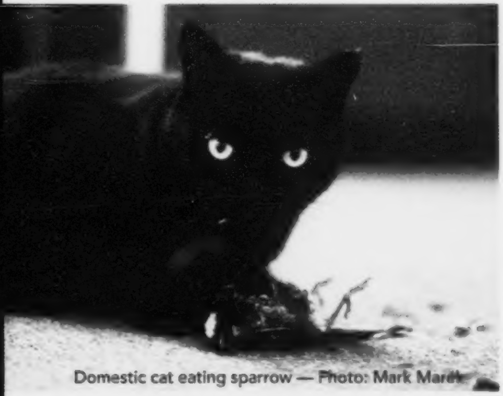
Southern Ontario landscape — Photo: Scott Gillingwater

"People who will not sustain trees will soon live in a world that will not sustain people."

Bryce Nelson

Flock of Brown-headed Cowbirds — Photo: Greg Lavaty

THE FRAGMENTED FOREST



Domestic cat eating sparrow — Photo: Mark Marek

Forest fragmentation is a landscape scale process that involves the breaking up of large continuous tracts of forest into smaller remnants of various sizes and shapes. It often results from the conversion of natural habitat into human modified land uses (agriculture, roads, urban areas, and utility corridors). Forest habitat is not only lost with fragmentation but the remaining habitat is reduced in quality and function due to the spatial arrangement, size and shape of remaining habitat patches. Associated increases in nest predation and brood parasitism often result in reduced reproductive success for bird species that historically bred in large, unbroken tracts of forest. Fragmentation has been implicated as a major cause in the decline of some songbirds. The severity of fragmentation effects depends on the surrounding habitat, termed the *matrix*. Forests surrounded by agriculture or urban development are typically more affected than those surrounded by forest patches of a different age, structure, or species composition. Agriculture and urban land uses often result in a permanent loss of habitat whereas timber harvesting may only temporarily reduce the availability of suitable habitat (i.e., prevalence of mature forest). As well, increased feeding opportunities (crops, bird feeders, garbage, etc.) in agricultural and suburban habitats support unnaturally high densities of predators (racoons, squirrels, chipmunks, crows, Blue Jays, and domestic cats) and Brown-headed cowbirds. Characteristics of remaining forest patches within a fragmented landscape determine their suitability as bird habitat. These characteristics are interrelated and include, the amount of edge, the size and shape of a patch, how well the patches are connected, the amount of forest in the region outside of the forest patch, and the features present in the landscape, known as *landscape composition*. These factors can individually or cumulatively influence all stages in the life cycle of birds, from settlement and pairing to reproduction and recruitment into the breeding population. As the relative importance of each of these factors can vary by species, biodiversity planning requires consideration of all factors at a large scale. It is now becoming increasingly evident that the future of Ontario's forest wildlife may depend on not only the amount and size of forests that remain, but on the location, shape, and characteristics of the land use in the surrounding landscape.

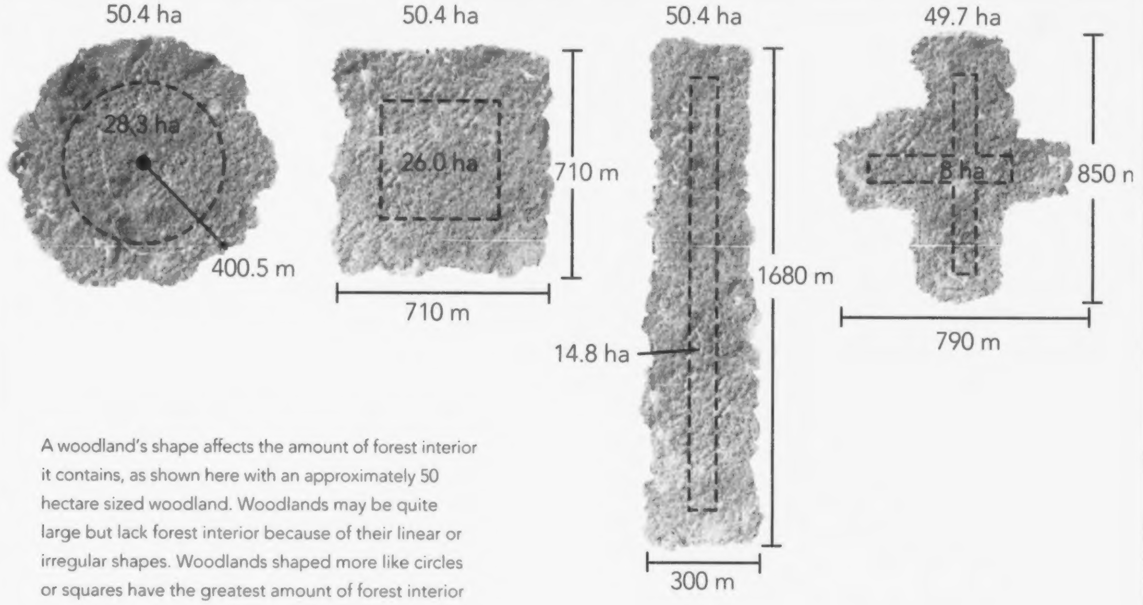
Edge

Edge is the transition zone between two different habitats or land uses. The interaction between two different habitats results in an *edge effect*. The more habitats differ from each other in structure the greater the intensity of edge effect. For instance, the structure of a forest is very different from an open field. Where these two habitats meet, is called a *hard edge*. In comparison, the structure of a mature deciduous forest is more similar to a plantation. Edges between these types of habitats are termed *soft edges*. In forests, edge effects can include *abiotic* (i.e., non-living) effects like increased light, heat, and wind; and *biotic* (i.e., living) effects like changes in the abundance of species or how well they survive. The result is an edge habitat that is very different in structure and function from that which is farther into the forest. For birds nesting at forest edges, predation and parasitism rates are often higher as nest predators and cowbirds are attracted to the shrubby, open habitat of the edge for locating nests. The amount and type of food available to breeding birds can be affected in edge habitat, as warmer, drier conditions alter insect communities. Some edge effects may extend 100 to 200 metres (m) into the forest, though habitat beyond 100 m is generally considered forest interior or *core* habitat. Several species, such as the Song Sparrow, are better adapted to

Edge habitat — Photo: Dawn Burke

Photo: Scott Gillingwater

How does woodland shape alter edge effects?



A woodland's shape affects the amount of forest interior it contains, as shown here with an approximately 50 hectare sized woodland. Woodlands may be quite large but lack forest interior because of their linear or irregular shapes. Woodlands shaped more like circles or squares have the greatest amount of forest interior proportional to their size and can have nearly double the interior space of narrow, rectangular woodlots of similar total area.

Artwork: OMNR

conditions at the edge *(edge specialists)*; others, like the Ovenbird, are vulnerable to edge conditions and avoid or experience reduced reproductive success at edges. These are called *forest interior specialists*.

Size and Shape

The ecological characteristics of small fragments are different from those of larger areas, principally owing to the edge effect and the inability of small areas to support viable populations of species that have large territories or home ranges. Small fragments of a habitat usually support fewer species than large areas. Species whose occurrence or reproductive success is reduced in smaller fragments are called *area sensitive* species. Many forest birds are known to be area sensitive, including the Cerulean Warbler that will only nest in large forest tracts (often greater than 500 hectares [ha]). Other area sensitive species, like Ovenbird may nest in smaller forest fragments but they are often unable to raise young successfully because of high rates of predation and parasitism. These smaller fragments often do not offer enough interior habitat protected from edge effects to sustain breeding populations. Generally, forests less than 50 ha will support only the occasional area sensitive species, while forests 100–200 ha will support most area sensitive species. The shape of a forest patch is very important because it influences how much edge and interior habitat a patch contains. Forest patches that are square or circular in shape have less edge and more interior than long rectangular patches of the same size (see figure). Patches with less interior forest habitat may be less valuable to area sensitive species, consequently shape should be an important consideration in landscape planning.

Photo: Scott Gillingwater

Source and Sink Dynamics

Many songbird populations are composed of a network of *sources and sinks* linked by dispersal. Across the landscape, sources are high quality habitats where populations tend to increase. The other patches, the sinks, are low quality habitats that, on their own, are unable to sustain populations. However, sink populations can persist indefinitely, if excess individuals produced in the source frequently move to the sink. For a considerable number of forest breeding birds, productivity is much higher in large forest fragments than in small fragments and within these large patches the populations tend to increase (sources). Thus large forest fragments can provide excess individuals to neighbouring small fragments where productivity is much lower and not adequate for population growth or stability (sinks). The value of large forests to bird conservation is generally, although not consistently, accepted, as these may be critical in maintaining regional populations of some songbird species. In agricultural landscapes, nest predation and brood parasitism levels can be so high that many forest habitats are likely to be sinks. Yet, area sensitive birds may persist in small woodlot islands if they are able to disperse to these patches from nearby, large source populations (i.e. large fragments greater than or equal to 500 ha). Small woodlots that are isolated from adjacent large, source woodlots will tend to have impoverished bird communities, and support fewer species and fewer individuals than the large woodlot. Loss or degradation of nearby large source habitats will lead to population declines at larger scales, within surrounding small woodlots, as these sources typically rescue populations on surrounding sink habitats from extinction. Permanent changes to the large forests through land conversion or degradation of these fragments could lead to regional collapse of the area sensitive bird communities.

Veery nestlings —Photo: OMNR

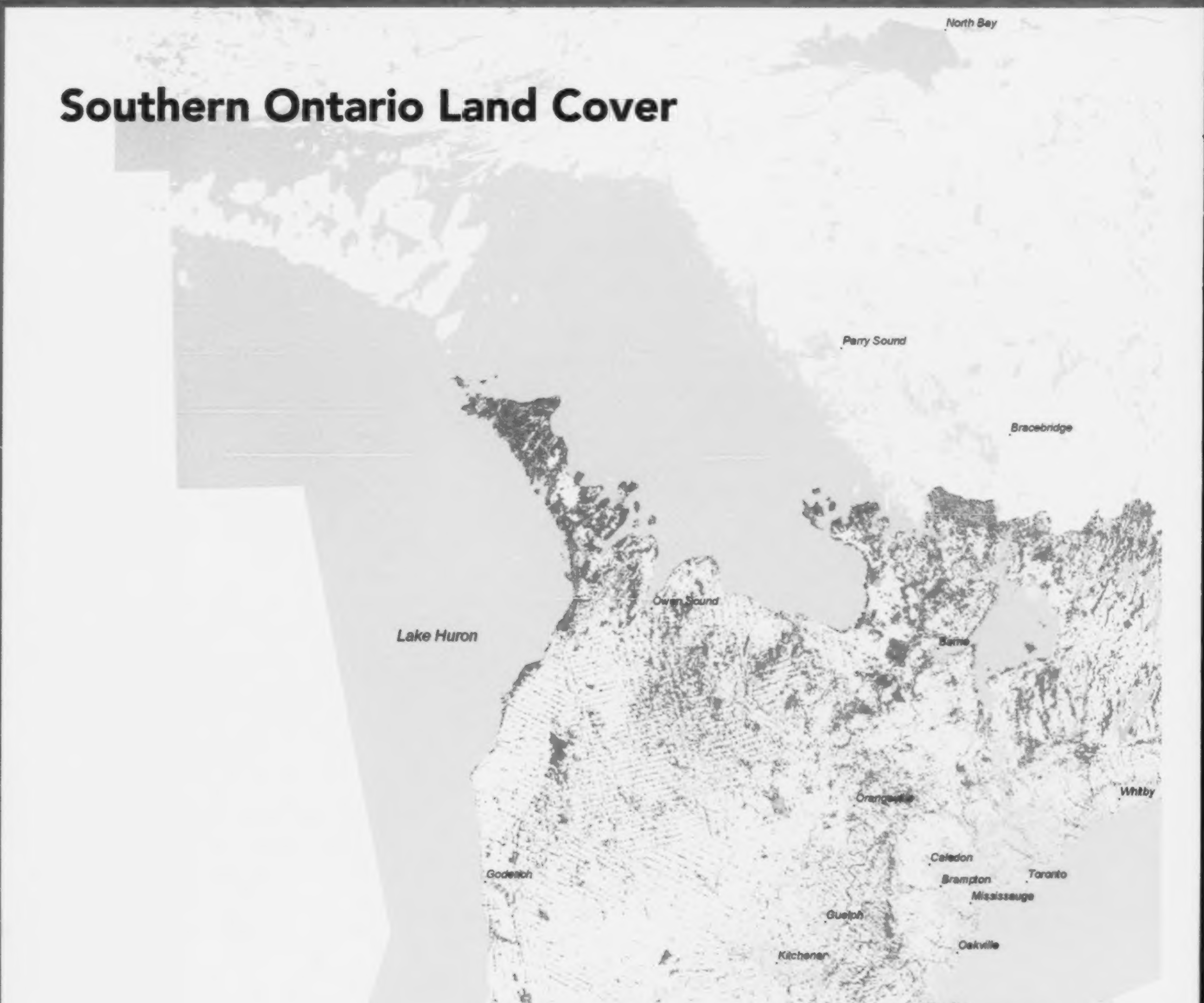
Connectivity

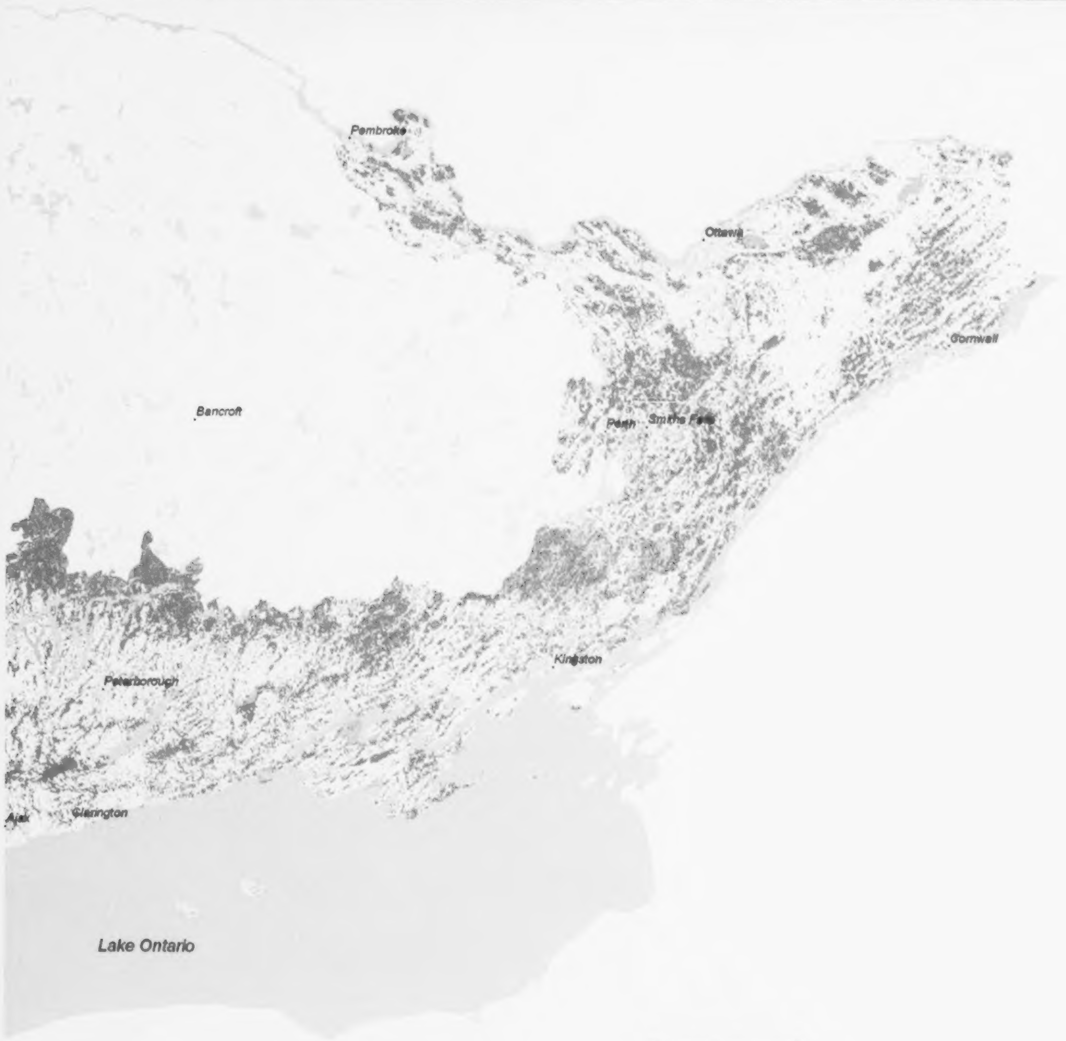
The proximity of a forest patch to nearby patches may be an important factor in the long-term maintenance of bird populations. Dispersal of young birds is important in source-sink dynamics (see *Source and Sink Dynamics* above) and can be limited when patches are isolated or the intervening habitat is difficult to cross (i.e., major highway). The degree to which forest patches are connected or their connectivity may be especially important for non-migratory species like many woodpeckers, owls, and species with limited dispersal abilities such as salamanders.

Regional Forest Cover

The loss of forest habitat may have the most significant effect on the distribution and abundance of birds. As forest cover in a landscape decreases, the number of forest bird species supported in that landscape also decreases. Areas of high forest cover are more likely to incorporate a wide variety of habitats and thus a greater diversity of specialized species. In the Ottawa-Carleton region, which is approximately 30 percent forested, 100 percent of the species that should occur in this landscape are present. In contrast, almost 40 percent of the suite of forest birds has been lost from Essex region, where only five percent forest cover remains. Many studies have identified a minimum threshold of 20–35 percent forest cover. When forest cover is above this threshold, habitat configuration (edge, patch size, and connectivity) will have little or no effect on the number of species or abundance of birds. However, below the threshold, habitat configuration plays a critical role in determining species composition.

Southern Ontario Land Cover





Legend

▨ Treed Areas

▨ Other Natural Areas

Agriculture, Aggregate and Other

▨ Built Up Areas

▨ Water

Imagery produced by the Provincial Geomatics Service Centre and map design by the Southern Region Information Management and Spatial Analysis Unit, Ontario Ministry of Natural Resources, Peterborough, Ontario. January 2009.

OMNR. 2006. SOLRIS Phase 1 Wooded Areas — 2006 Release (WOODAREA). Ontario Land Information Directory of Metadata for Geospatial Information Holdings.

Ontario

1:700,076

European Starlings—Photo: J. Fuhrman/VIREO

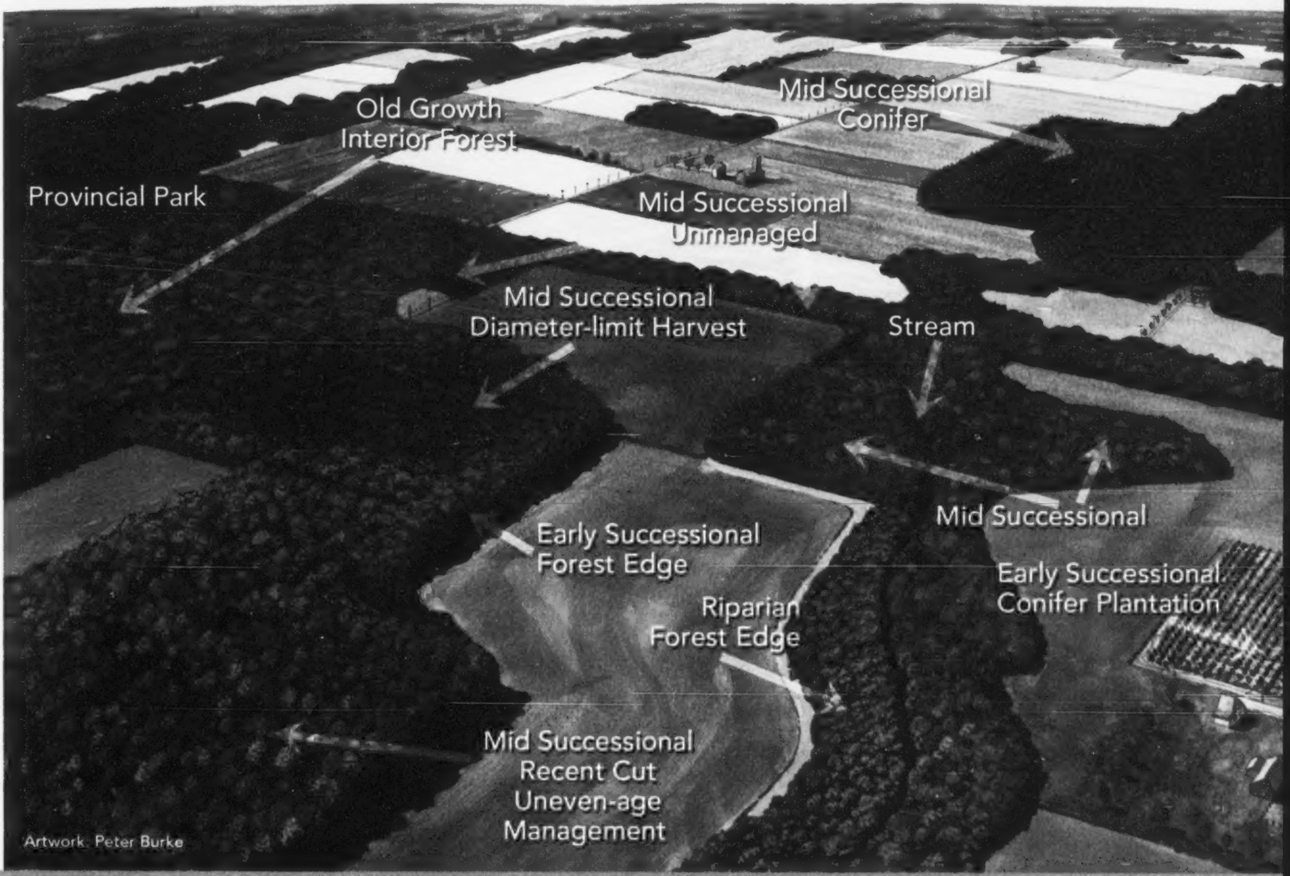
Landscape Composition

The habitat quality of a forest patch needs to be considered in a landscape context. For instance, the value of a 50 ha forest fragment in providing habitat for area sensitive birds depends considerably on the amount of regional forest cover. A large forest patch may be more important in a heavily fragmented landscape where it is the only forest patch in which birds are able to survive and reproduce, compared to an extensively forested region where it is one of many. Bird populations do not exist in isolation. Effective management hinges on considering the composition of the surrounding landscape as well as the patch itself. A rich landscape will have a diversity of habitat types at a variety of successional stages including: old growth forest, deep interior forest, mid-successional forest, and early successional forest. Ultimately, such a landscape would have the greatest potential to support the greatest diversity of species.

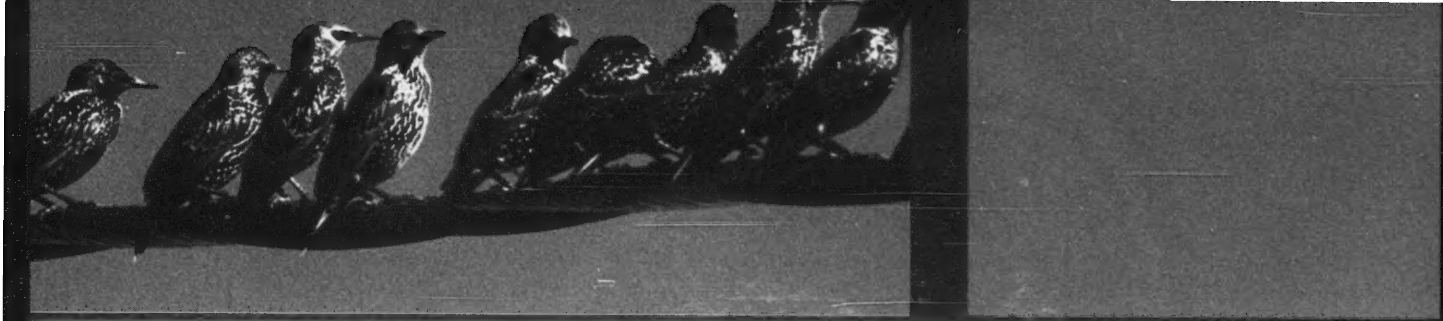
Urban Sprawl and Urbanization

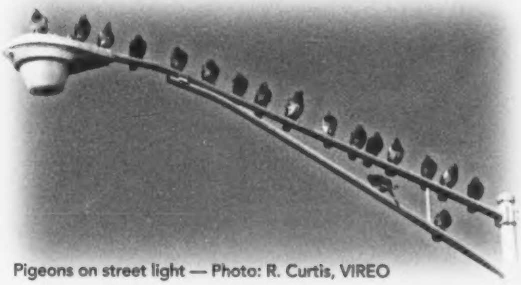
Another major process affecting forests of southern Ontario is urbanization, which includes the expansion and sprawl of cities, towns, and villages and the trend towards rural living. This often entails the construction of subdivisions and individual homes within or adjacent to woodlots. Urbanization is particularly damaging to natural landscapes because the conversion from a forest to an urban environment of pavement and buildings is not only permanent but is occurring on a large scale. Urban sprawl results in habitat loss and fragmentation, as well as numerous human induced stressors that are either exclusive to, or greatly amplified in urban areas. When we look at the urban gradient we see changes in species composition, diversity, and abundance. The changes that occur at the urbanized end are those associated with a loss of bird species in the region as well as a decrease in the ability of the forest to perform some functions, like cleaning

Typical Southern Ontario Landscape



Artwork: Peter Burke





Pigeons on street light — Photo: R. Curtis, VIREO

the air and water. Urban animal communities are dominated by a few super-abundant species. As you move into suburban and rural development, this land-use does not invariably destroy forests, but can radically alter the surrounding landscape. While a few species can adapt to human shaped environments, many cannot. Sprawl occurs at the expense of many species that depend on fragile local habitats. In particular, sprawl will cause a decline in habitat specialists and less mobile species.

Adjacent Housing

The impact of adjacent housing, roads, human activity, and exotic species can lead to severe habitat degradation in urban and rural environments. The number of houses surrounding a forest patch can affect its habitat suitability for many Neotropical migrants. For example, a study in Ontario found Wood Thrushes were absent from fairly large woodlots that were surrounded by numerous houses, but were frequently found in small woodlots with few or no houses on their borders. The presence of houses can also reduce productivity. Houses harbour dogs and cats that may destroy nests, and lawns that provide rich feeding grounds for cowbirds. Houses placed adjacent to a woodlot rather than within a woodlot have less of a negative impact on forest bird populations. In Ontario, though forest cover has increased over the past few decades, fragmentation has also increased at least in part due to an increased intrusion of rural residences into the forests.

Photo: Dawn Burke

Roads

Roads can create barriers to movement. Forest birds may avoid crossing roads or suffer increased mortality from crossing roads. Vehicle traffic noise can be a significant stressor to nesting songbirds, and breeding bird densities are often reduced along roads with high traffic volume. Roads act as edges and forest birds nesting along them may suffer higher rates of predation and parasitism.

Road bisecting forest — Photo: Lucas Foerster

Exotic Species

As habitats become urbanized the number of exotic and invasive plants often increases at the expense of native vegetation. The vegetation structure in urban areas is often simplified with fewer dead standing trees, less cover at mid and upper levels, and more ground cover than in natural environments. This reduces bird diversity as specialized groups, like cavity nesters, canopy feeding, and bark foraging guilds are replaced by high densities of generalists or non-native species, like European Starlings and House Sparrows that thrive in heavily disturbed environments. Exotic vegetation can have reduced insect biomass, thus providing less food for breeding birds. Species nesting in this vegetation may suffer increased predation, due to poor habitat structure.

Female Northern Cardinal — Photo: Brandon Holden

Forests and Climate Change

Climate change is global in its causes and consequences may be the greatest challenge to face man.

The scientific evidence is overwhelming and clear; climate change is a stark reality. *Human activity* is largely responsible for climate change and it presents very serious risks for people and biodiversity worldwide. These activities, particularly the burning of fossil fuels, are rapidly increasing levels of greenhouse gases such as carbon dioxide, causing the atmosphere to heat up.

Although the Earth's climate has changed repeatedly in the past, the current situation is different. Human activity is largely responsible for the changes we are experiencing, the *scale* of impact is greater than has been experienced for hundreds of thousands of years, and these changes are happening at an *unprecedented rate*. By the end of this century, climate change impacts may become the leading direct cause of biodiversity loss.

We know that the changes biodiversity faces due to climate change will be substantial and wide reaching in terms of scale and speed. However, we cannot predict with certainty how or when individual species will respond to climate change, or how ecosystems will change. The effects of climate change include increased extreme weather (heavy rainfall, wind events, severe winter storms, and droughts), the retreat of mountain glaciers, the thawing of permafrost, and lengthening of growing seasons. Egg laying, flowering, and spawning are occurring earlier for many species, in some cases disrupting delicate cycles that ensure that insects and other food are available for young animals. Many species will show changes in abundance, and experience shifts in their ranges in order to survive, with considerably more losers than winners expected. Additional consequences may include spread of disease, alien invasive species, and pest populations, changes to vegetation communities and disturbance regimes, and ultimately, the increased risk of extinction for a number of vulnerable species.

Forests play a crucial role in mediating the effects of climate change at a global scale. Elevated levels of carbon dioxide (CO_2) in the atmosphere cause temperatures near the surface of the earth to rise (the *greenhouse effect*). Yet, forests provide an important service, in terms of carbon sequestration by removing CO_2 from the air and releasing oxygen, for us to breathe. This carbon is then stored in trees which allows them to act as *carbon sinks*. The capacity of this carbon sink is massive, as forests worldwide currently store more than an estimated one trillion tons of carbon. This is twice the CO_2 found in the atmosphere. The maintenance and conservation of healthy forests becomes increasingly important in the face of climate change. When you harvest, you release CO_2 through disturbance of the soil, and decomposition of leaves and slash. Careful management can neutralize the effect of this released CO_2. Forest operations that maintain vigorous, fast growing, healthy trees will effectively increase carbon sequestration rates. Careful management practices that reduce damage to remaining trees, reduce logging waste, implement soil conservation practices, and produce solid wood products, ensure that you conserve a large fraction of carbon. Habitat conservation and appropriate management, particularly restoration, can play a crucial role in sequestering carbon and reducing greenhouse gas emissions. When you clear forests for other uses such as agriculture or housing, you release huge quantities of CO_2 to the atmosphere. Through planting and restoration work, you can increase the amount of fast growing forests on your landscape, which have a greater capacity to withdraw carbon from the atmosphere. Your goal to practice good forestry to maintain healthy forests on the landscape, and increase forest cover, will result in an increased capacity to store carbon in trees, soils, and forest floors.

Typical big city traffic in southern Ontario — Photo: Microsoft

Northern Cardinal — Photo: Daniel Cadieux

Birds and Climate Change

The impact of climate change on birds in North America is already evident for a number of species. Nearly 60 percent of the 305 species found in North America in winter are on the move, shifting their ranges northward by an average of 56 km. Elevated spring temperatures have led to earlier egg laying (approximately 6.6 days earlier per decade) and earlier spring migration (nearly a third of migrants are arriving earlier in Canada). Species incapable of synchronizing migration with breeding ground resource availability are at a severe disadvantage. Latecomers may not have sufficient food resources throughout the breeding cycle and they may be too late to find a suitable nest. Longer summers and warmer winters are postponing fall migration (half of migrating songbirds studied) and have even led to the complete cessation of migration in some species (e.g., Canada Geese in southern Ontario). In Ontario, overall warming effects over the past 20 years have resulted in northward range expansions and/or increased densities at the edge of their range for a variety of species (e.g., Tufted Titmouse, Blue-gray Gnatcatcher, Northern Mockingbird, and Red-bellied Woodpecker).

Climate change may be partially responsible for the decline of birds that feed on flying insects (aerial insectivores). This includes Whip-poor-wills, nighthawks, swifts, swallows, martins, and flycatchers. They have demonstrated alarming declines, particularly in eastern Canada, including many forest-dwelling species common to agricultural landscapes like Eastern Wood-Pewee, Least Flycatcher, and Great Crested Flycatcher. It is believed that the overall abundance of aerial insects is declining, and/or that shifts are occurring in their distribution or peak timing of seasonal emergence because of climate change. Many kinds of flying insects have an aquatic stage that is very sensitive to changes in the aquatic environment. Marked increases in UV radiation and changes in water temperature through climate change can reduce their populations. Most insects are also sensitive to changes in temperature and precipitation extremes. As such, short-term disturbances in climate could affect seasonal timing of insect availability. If avian life stages, such as feeding young, become mismatched with insect availability than these aerial insectivore bird populations are likely to decline.

> **Only within the moment of time represented by the present century has one species — man — acquired significant power to alter the nature of his world.**
>
> **Rachel Carson**

Flock of Canada Geese in winter —
Photo: Terry Sohl

Great Crested Flycatcher —
Photo: Robert McCaw

Photo: Ken Elliott

> "When we use the tree respectfully and economically, we have one of the greatest resources on the earth."
>
> **Frank Lloyd Wright**

Photo: Larry Watkins

FOREST HARVESTING

Silviculture is the art and science of controlling the establishment, growth, composition, and quality of forest vegetation to meet the diverse needs and values of landowners and society on a sustainable basis.

Forests are not static, but change constantly, sometimes dramatically, and other times more gradually. Over the course of human history, forests have received growing pressure from population growth, spreading infrastructure, invasive species, pollution, expanding and intensifying agriculture and forestry, and now climate change.

Silviculture is the art and science of controlling the establishment, growth, composition, and quality of forest vegetation to meet the diverse needs and values of landowners and society on a sustainable basis. Silviculture is often confused with managing forests purely for timber. However, modern practices are ecosystem based, and take into account additional ecological considerations and resource objectives such as wildlife, recreation, water, and aesthetic values. A silvicultural system has the following basic attributes:

- satisfies the goals and objectives of the landowner
- provides for timely availability of many forest resources (not just timber)
- produces predictable harvests over the long term
- balances biological/ecological and economic concerns to ensure renewability of resources
- provides for regeneration
- effectively uses growing space and site productivity

Tree harvesting is a very prevalent activity and major force influencing the structure, composition, and quality of remnant forests of southern Ontario. Silviculture systems present different approaches to harvesting, regenerating, and growing forests. These systems mimic natural disturbance patterns and allow for sustainable harvest of forest products while providing for wildlife habitat and recreational opportunities. The three main silviculture systems used in Ontario and world wide include the selection system, the shelterwood system, and the clear cut system. We can divide these systems into two broad categories: even-aged and uneven-aged management. Determining the appropriate system to use depends on the species and site characteristics of a forest stand and landowner goals and expectations. Except for *clear cutting*, all systems entail partial harvesting, because they retain a portion of the mature trees on site.

Photo: Ken Elliott

Young forest — Photo: OMNR

Shade and moisture conditions shape tree species composition

Tree species differ in their abilities to survive under varying moisture and light conditions. Some can tolerate extreme dryness (drought) and others, excessive flooding. Some species survive while living in the shady conditions of a mature forest floor. These trees are considered to be *shade-tolerant*. The Shade and Moisture Tolerance of Various Tree Species table (opposite) are used to classify southern Ontario tree species based on their ability to adapt to these environmental conditions. This will help guide land managers in deciding what silviculture system will be most appropriate for a given mix of species.

Shade-tolerant (low light)

Shade-tolerant species can germinate and survive in the shade of the forest canopy. The most tolerant species can live as long as 40 years in the shade. When an opening is created from a tree dying or falling, the small shade-tolerant trees will quickly grow up to fill the gap and take their place in the canopy. Forests canopies comprised of primarily large shade-tolerant species such as sugar maple, beech, and hemlock are often considered to be at the end stage of succession known as the *climax* or *late successional forest*.

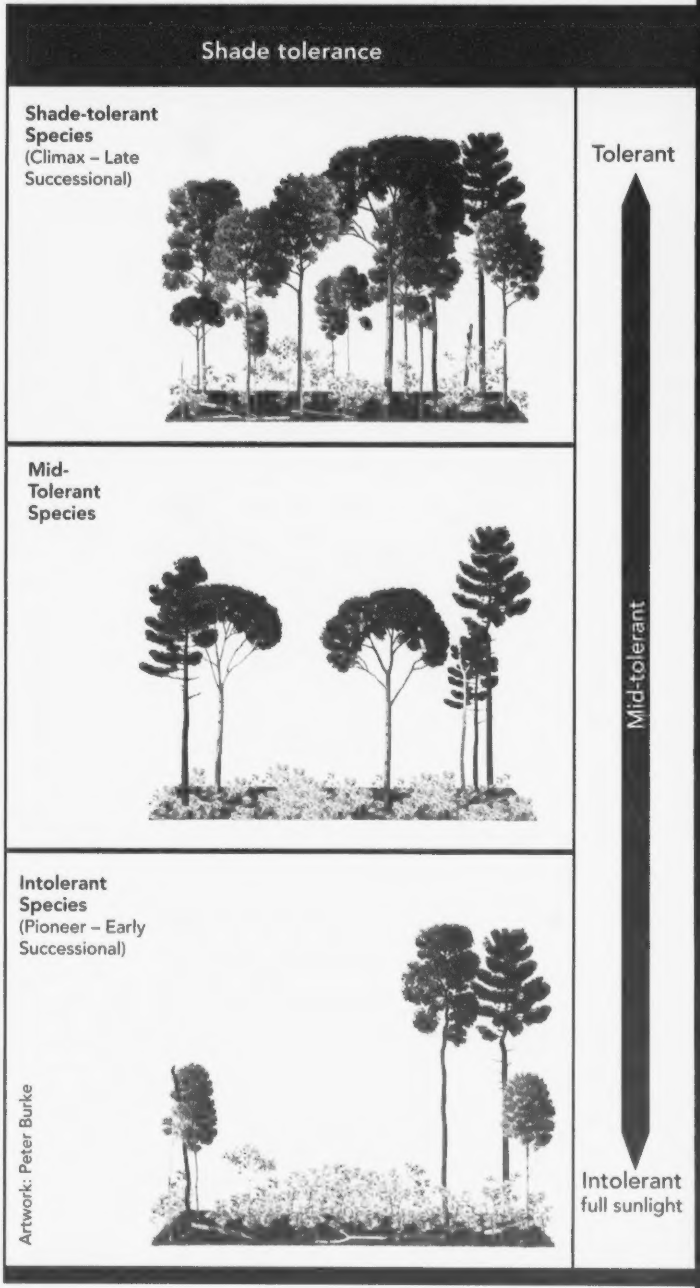
Mid-tolerant (medium light)

Mid-tolerant species can germinate in shady conditions but will die within 1–3 years if they do not receive some light, for at least part of the day. Mid-tolerant species such as oaks and white pine evolved from a history of heavy ground fires. These fires kill all the low shade and some of the canopy trees to provide a partially shaded environment. During Ontario's settlement phase the heavy disturbances associated with land clearing provided ideal conditions for many mid-tolerant forests to become established. However, the past 70 years of minor disturbance (such as single tree selection) and fire suppression has allowed succession to continue towards more tolerant species, favouring the replacement of mid-tolerant canopy trees in many remnant woodlots.

Shade-intolerant (full sunlight)

Intolerant tree species need full sunlight to germinate and survive. In open conditions they out-compete both the tolerant and mid-tolerant trees. Species like white birch, red pine, trembling aspen, tulip tree, and sassafras are considered to be intolerant species. These species are *colonizers* or *early successional species* that dominate even-aged forests where large disturbances such as fires or big wind events have occurred.

Shade and Moisture Tolerance of Various Tree Species



Artwork: Peter Burke

Tree species	Additional Carolinian species	Moisture tolerance
sugar maple, American beech, ironwood	American chestnut, big shellbark hickory, rock elm, pignut hickory,	UPLAND
eastern hemlock, balsam fir, red spruce	black maple, blue beech, pawpaw	BOTH
black spruce	black gum, slippery (red) elm, red mulberry	LOWLAND
white ash, red oak, white oak, white pine	black oak, Ohio buckeye	UPLAND
red maple, white spruce, American (white) elm, white cedar, butternut, bur oak, bitternut hickory, basswood	shagbark hickory, cucumber tree, hackberry	BOTH
silver maple, Freeman maple, yellow birch, red (green) ash,	swamp white oak, sycamore, blue ash, pumpkin ash,	LOWLAND
black cherry, red pine, jack pine, pitch pine, red cedar, Chinquapin oak	tulip tree, sassafras, northern pin oak, honey locust, dwarf hackberry, dwarf, Chinquapin oak	UPLAND
trembling aspen, large-tooth aspen, cottonwood, white birch	flowering dogwood, black walnut, common hop-tree	BOTH
black ash, balsam poplar, tamarack, black willow	Shumard oak, pin oak, Kentucky coffee tree	LOWLAND

Feller buncher — Photo: Ken Elliott

Even-aged Management

In even-aged forests, all dominant trees are essentially the same age (usually within 10 years). Even-aged management involves removing all mature trees either in a single cut (clear cut) or with multiple partial cuts (shelterwood harvesting). It is most appropriate for the regeneration of sun-loving species like oak, pine, and poplar (see *Shade and Moisture Tolerance of Various Tree Species* on pages 36–37). The clear cut system mimics natural, but infrequent major disturbances like wind and fire, which create large gaps in the forest where species intolerant of shade can grow. The shelterwood system is advantageous for species that are able to survive less intense, frequent disturbances such as ground fires that kill competition. These frequent low intensity burns actually build a bigger, healthy root mass in species like red oak, allowing it to re-sprout and grow vigorously. Occasionally managers use shelterwood harvesting in parts of southern Ontario where oak and pine forests dominate. However, clear cutting is rarely used in this part of the province, although silviculturally appropriate in some cases.

Clear Cut System

In a clear cut system, you remove all the mature trees in one cutting operation. Regeneration can occur naturally by windborne seeds from nearby areas, seed banks, seeds from mature trees left on site, re-sprouting from stumps, (*coppice growth*), sprouting roots, or through human assisted seeding and planting. Clear cut harvests favour shade-intolerant species that need full sunlight to grow such as red pine, poplar, cedar, and white birch. In Ontario, clear cutting is most suitable for boreal forests that have evolved under large-scale catastrophic disturbances like fire and insect infestations. Although appropriate for some southern Ontario forest types, municipal by-laws, cultural, aesthetic, and environmental concerns over the last 25 years have virtually eliminated the use of clear cutting.

Shelterwood System

The shelterwood system involves a series of two or more partial cuts that systematically remove all but a few mature trees from a stand over a 5–60 year period. Tree cutting stimulates growth by increasing light levels, while a partial canopy provides seed and shelters new seedlings from the severe open environment (sun, heat, and frost). In a *preparatory cut*, you thin the stand giving selected trees room to grow large crowns. If sufficient trees with large crowns are already present then the manager may omit this cut. In the *seed* or *regeneration cut* about half the mature trees are removed allowing sunlight and seed to reach the floor and stimulate the germination and growth of seedlings. Once a dense layer of saplings has established (3–15 years), you would

Clearcut — Photo: Lindsay MacLean Abbott

Red oak shelterwood cut — Photo: Scott Reid

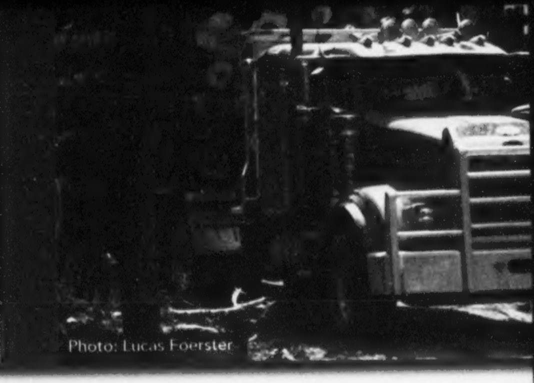


Photo: Lucas Foerster

normally perform a *removal cut* to harvest most of the remaining mature trees. This gives the sapling layer full sunlight and encourages rapid growth. There can be two removal cuts separated by a number of years.

Crop Tree Management
Crop tree management is useful for those interested in thinning younger, often even-aged forests. This technique focuses on retaining the trees *(called crop trees)* with the best long-term potential early in the life of the stand. Typically, the selected trees are healthy and vigorous to promote good growth and long-term survival. However, crop trees may be retained for other objectives such as: to promote species diversity, provide wildlife trees, increase seed (*mast*) production, provide specialty crops (maple syrup), wood products (veneer, sawlogs, utility poles, etc.), or for aesthetics. Once crop trees are selected (often identified with blue paint) trees that have crowns touching or overlapping these trees are removed. This provides optimum growing space for the crop trees and directs management towards these individual trees that have the greatest potential to meet longer term objectives. Additional thinning is usually conducted once the crowns close to maintain growth on the crop trees.

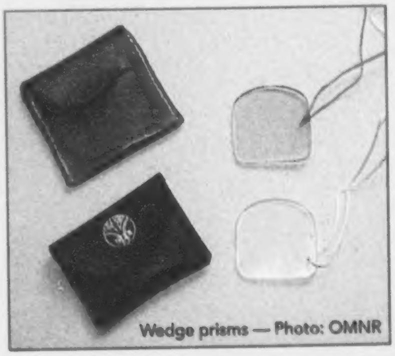
Marking under single-tree selection — Photo: Ken Elliott

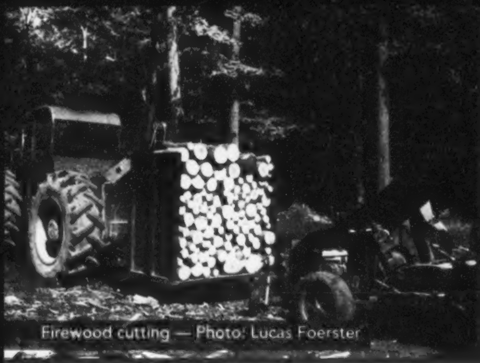
Uneven-aged Management

Uneven-aged management or the selection system creates or maintains a stand of predominantly shade-tolerant and mid-tolerant species where trees of all ages and sizes make up the stand. The forest canopy is kept intact as individual trees (single tree selection), or small patches of trees (group selection) are removed. Ideally, each harvest removes a third or less wood volume or basal area (defined as tree density—see *Basal Area* below), and thinning is distributed across trees in all size classes. This allows for improvement in quality and growth across all ages. Selection harvesting is well suited to most deciduous hardwood forests of southern Ontario. It is designed to mimic the frequent, small-scale disturbances such as wind, ice storm, lightning, fire, or disease under which the hardwood forests of eastern North America historically evolved. Periodic harvesting, on an 8–20 year *cutting cycle*, allows a steady supply of wood products, while maintaining a structurally diverse forest

Basal Area

Basal area (BA) is the combined total of cross-sectional areas of all trees at breast height (1.3 m above ground) per hectare of forest (metres squared per hectare [m^2/ha]). It is an index of the number and size of trees in a stand, and used by foresters and ecologists to estimate the volume and density of a stand to help determine whether another harvest or thinning is appropriate. Basal area is a major stand attribute influencing which species of birds are present, their density, and their productivity. As large trees contribute proportionately more toward stand basal area measures, stands with high basal areas, will often support higher densities of large mature trees. For stands in southern Ontario, retaining an average basal area of 20 m^2/ha with trees representative of all age classes is generally recommended for optimal growth. A wedge prism is a tool commonly used to assess basal area. By taking multiple estimates of BA at various points throughout a stand, a manager can get an estimate of the overall stand BA.


Wedge prisms — Photo: OMNR


Firewood cutting — Photo: Lucas Foerster

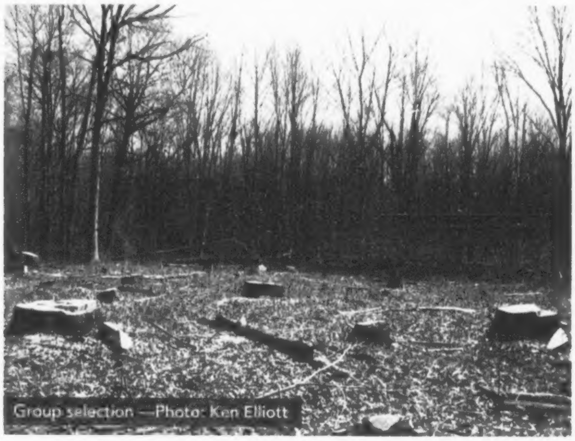
ecosystem that provides wildlife habitat and recreational opportunities. Selection harvesting requires careful planning, including consultation with professional foresters.

Single Tree Selection System

Under single tree selection, you can achieve a target basal area or density by removing individual trees from a range of size classes throughout the entire stand. Since you are creating small gaps, the size of one or two tree crowns in the canopy, single tree selection encourages the growth of shade-tolerant species such as maple, beech, ironwood, and hemlock. Generally, this system involves evaluating individual trees and targeting the removal of low quality, unhealthy trees, while promoting the growth of trees with desirable characteristics for timber, wildlife, seed production, or other landowner values. Often trees to be cut are marked with yellow or orange paint prior to harvesting. A good single tree selection prescription in combination with tree marking, and careful harvesting optimizes the growth and increases the quality of a woodlot over time.

Group Selection System

Group selection opens up the canopy more than single tree selection by removing trees in small patches. Gaps are created with diameters ranging from one to two times the canopy height to encourage the growth of mid-tolerant and intolerant tree species such as yellow birch, red oak, white ash, and black cherry. This creates a patchwork of openings embedded in a mature, uneven-aged forest. By placing your gaps near a seed tree or an existing natural gap you will enhance the regeneration of less shade-tolerant species. The intensity of group selection can range from very few scattered gaps to many group openings.


Group selection —Photo: Ken Elliott

Group selection can be used in isolation or in combination with single tree selection. By matching the volume of wood removed from a prescribed number of gaps based on size and distribution to the growth rate of the stand, foresters ensure the sustainability over the cutting cycle (the time until next harvest).

Stand Improvement and Firewood Cutting

Many woodlots suffer from a history of poor management or mismanagement through *high-grading* (harvesting the best quality timber), over cutting, grazing, maple syrup operations, and harvesting damage. Many woodlots contain trees that have health issues associated with weather, disease, insects, or past management regimes. This can create an accumulation of dead and declining trees and increased prevalence of fungal diseases such as root or heart rot. When this occurs, we recommend you focus your initial management on stand improvement thinning under the general direction of the selection system. This will improve the health, genetics, and vigour of the stand. We have provided further details on rehabilitating degraded woodlands on page 80.

Firewood cutting — Photo: Eric Boysen

Logging damage — Photo: Lucas Foerster

Other landowners may have a more passive approach to management that involves regular removal of standing and fallen dead trees that accumulate. Often landowners see this removal of dead wood as a harmless way to "clean up" their woodlot.

Diameter-limit cut — Photo Ken Elliott

However, removing the supply of dead trees (snags), cavity trees, and downed wood is not a recognized silvicultural system, and can have negative consequences for wildlife habitat, and ecosystem health and function.

Diameter-limit Cutting

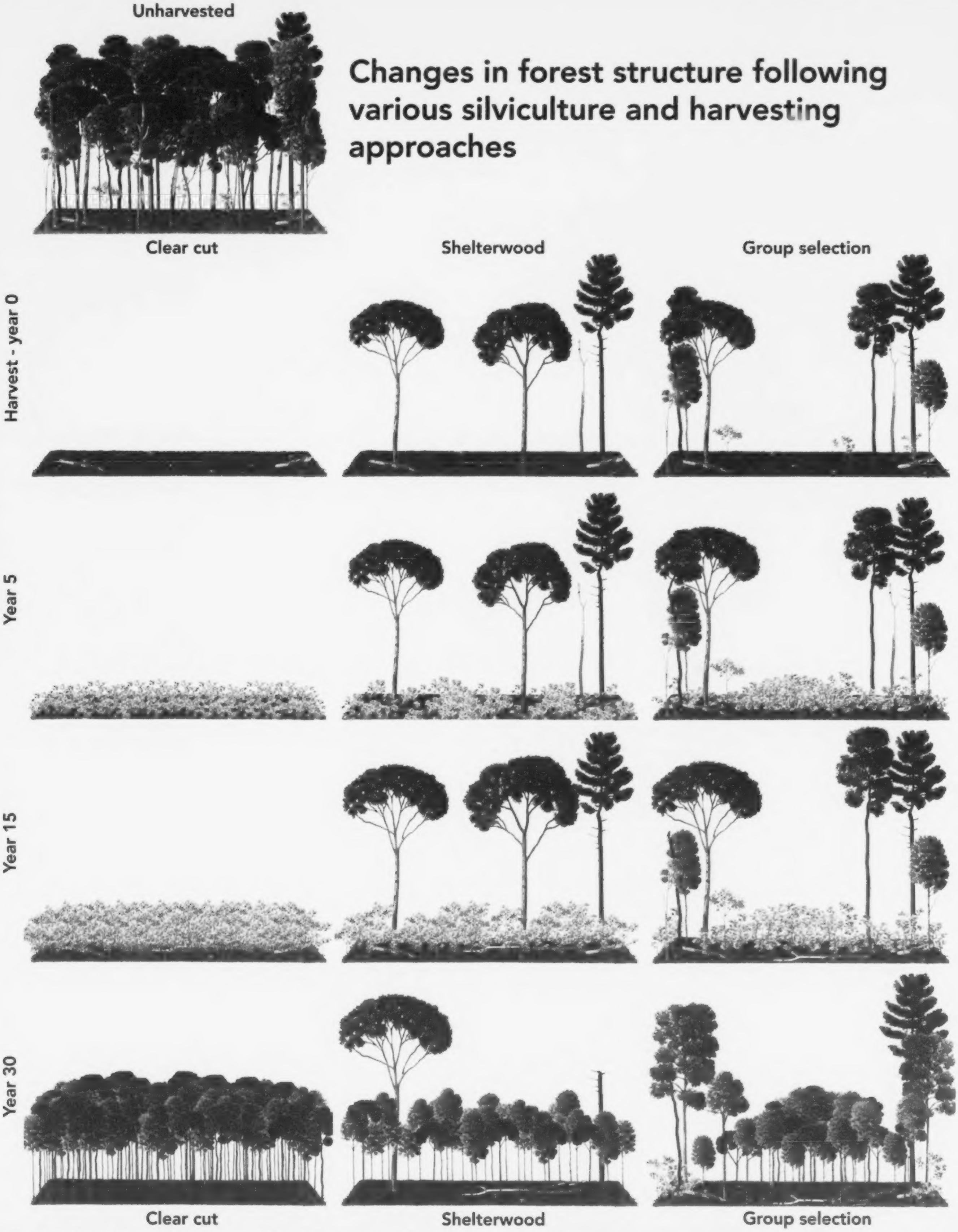
Diameter-limit cutting is the most commonly used harvesting method in southern Ontario. This is due to a long history of use as a by-law regulation method and its simplicity for both enforcement and operations. Landowners often make use of diameter-limit cutting for short-term economic gains, threatening the long-term economic and ecological potential of the forest. *Diameter-limit or circumference-limit cutting is not a recognized silvicultural system.* It involves the removal of all trees in a forest larger than a specified diameter or circumference. If the diameter-limit chosen for a harvest is high (50 cm or more), then few trees may be cut and the resulting stand structure may be similar to that of a selection harvest. However, if the diameter-limit is small (25–30 cm), many trees would be cut and the resulting stand will have no large trees, a very open canopy, and will be more even-aged in structure. Heavy diameter-limit harvests can resemble high grading, removing only the biggest and best timber.

Forest Conservation By-laws

For the past 60 years, municipalities have used forest conservation by-laws, otherwise known as tree cutting by-laws, to regulate the cutting of forests on private land. By-laws adopted diameter-limit cutting as a method of preventing the widespread practice of clear cutting forests. Most by-laws use diameter or circumference-limit targets as the minimum regulation tool. The by-law stipulates a specific diameter for each tree species. Land managers can only cut trees above this diameter. Municipalities see this by-law as a simple, easily enforced method of ensuring that forests remain on the landscape by preserving smaller, young trees as growing stock. While relatively easy and cheap to implement and enforce diameter-limits result in less financial return over the long term and fail to protect high quality wildlife habitat. Cutting according to good forestry practices is now being encouraged in various municipal by-laws, setting the stage for better management of our forest resources. This will maintain healthy forests on our landscapes to meet long-term ecological and economic goals.

Photo: Lucas Foerster

Changes in forest structure following various silviculture and harvesting approaches



Artwork: Peter Burke, Graphic Design and Editing: Lyn Thompson and Ken Elliott

This table illustrates the structure and composition of a typical deciduous forest in southern Ontario under six different harvesting methods at five distinct time periods over the course of 30 years. Forests with more vertical structure or layering will provide more habitat types for a great variety of forest bird species. The **unharvested** condition is the starting point for each of the six cutting scenarios, and reveals a multilayered structure that is the product of a forest left undisturbed for many decades. **Year 0** illustrates the immediate impact of tree removal. **Year 5** shows the amount of growth and development that occurs within the first five years following harvesting. **Year 15** shows the structure and composition at 15 year mark following harvesting. With shelterwood, group selection, stand improvement, and single-tree selection another harvest would likely occur around Year 15. Trees considered for removal are marked with a spot of orange tree marking paint on their stem. **Year 30** shows another 15 years of growth and development on the trees that remained following the initial harvests and the regeneration from Year 0 and Year 15. Each frame in this diagram shows a different stand structure within this 30 year period. If our landscape included a mixture of these 25 varying stand conditions along with others, such as old growth, then we would provide a broad range of habitats over the long term, for a broad range of species, while also allowing for economic returns from the harvesting of wood products.

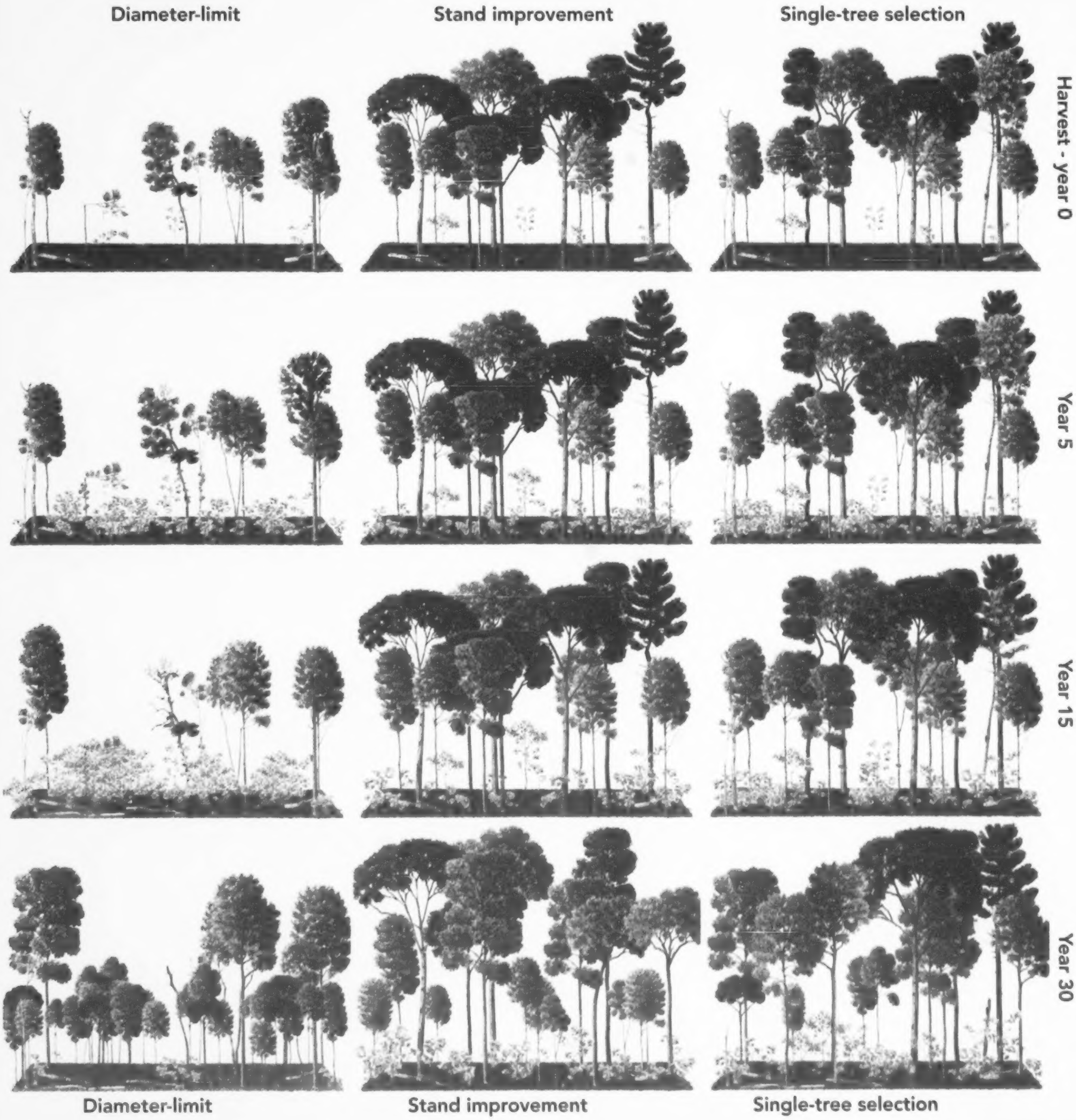


Photo: Doug Tozer

This method has several limitations that can negatively affect the health of the stand over time. This method fails to control the number of trees (basal area), balance of species, or the quality of the trees that remain. Often many of the smaller trees that remain are slower growing, genetically inferior trees, or less desirable species. After repeated cuts, stands harvested using diameter-limit will have compromised health, diversity, and productivity as the best individuals are often removed each harvest, leaving successively poorer growing and poorer quality trees for regeneration. Stands tend to reestablish poorly, have a simplified stand structure, and provide only marginal wildlife habitat. Despite being widely recognized as a poor forestry practice, most municipal tree conservation by-laws approve diameter-limit cutting as the minimum standard.

Selective Cutting or High Grading

Unlike the selection system, *selective cutting* can be grouped with *high-grading* as a form of harvesting that is not recognized as a silvicultural system and is not considered good forestry. Generally speaking this form of cutting involves the removal of the best trees or tree species leaving poor quality stands with trees of the poorest genetics to remain as breeding stock for future stands. Unscrupulous operators may portray this as a light form of harvesting; sometimes only a few trees are removed, however the long term impact of repeated high-grading cannot be underestimated. Today's land managers should no longer use this obsolete practice.

Red pine plantation — Photo: Ken Elliott

Managing Conifer Plantations

Conifer species (evergreens) such as white pine, hemlock, and white cedar are important components of southern Ontario woodlands. In many cases these species are present in smaller numbers than they would have been historically. Unlike most hardwood species, many conifers tend to grow in pure stands. Currently, conifer plantations provide this small, but important biodiversity element to the southern Ontario's landscape.

Plantations serve a variety of values. They operate as nurse crops for hardwoods, accelerate or encourage forest succession, rehabilitate and stabilize the soil, shorten the time frame for economic return of forest products, act as a windbreak, or serve as a financial investment. Plantations may add diversity to a landscape, link degraded or fragmented forest patches, stabilize eroded areas, and protect waterways. Although conifer plantations tend to provide limited food for wildlife, they have tremendous value for a variety of species as a source of protection from the elements and from predators. A number of bird species rely on forests that contain conifers including: Pine Warbler, Yellow-rumped Warbler, Black-throated Green Warbler, Pine Siskin, Red-breasted Nuthatch, and Northern Goshawk. Plantations often serve as a good first step to restoring blowsands and marginal farmlands into forest. By nature conifers are typically the first species to colonize areas that are devastated by fire or other major disturbances, and through the natural processes of succession eventually evolve into a mixed hardwood forest.

Considerable effort over the past 100 years has gone into restoring forest cover to some of the most disturbed, eroded, fragile, and otherwise unproductive lands through the planting of conifers. These were chosen due to their ability to tolerate the harsh, open conditions of the often dry and infertile blowing sandy areas (called blowsands). Adapted to these early successional conditions, conifers make an obvious first choice for modern restoration efforts. However, techniques have been developed for establishing more diverse mixes of trees, shrubs, and other plants where conditions and management resources warrant this approach.

Like many natural early successional forests, conifer plantations often begin as a single species (monoculture) established at high density spacing. The land quickly becomes closed in by a canopy of trees, with some grasses, forbs, and shrubs. Once the closed canopy condition is established (5–10 years) the forest floor becomes an open, unvegetated, low diversity monoculture. The trees continue to grow rapidly until 10–25 years of age when competition (for

Conifer plantation — Photo: Ken Elliott

light, water, space, and nutrients) between the planted trees starts to reduce their growth. It is at this point that managers should consider thinning to maintain the growth, quality, and health of the remaining trees. This also adds the disturbance necessary to establish the regeneration of a diversity of deciduous species that are better suited to the later stages of succession, when a more humid and less harsh forest microclimate exists. If left unmanaged, growth will slow, and eventually trees begin to weaken and die due to a lack of resources. As trees weaken, they are more susceptible to insects and disease. Without thinning, wildlife diversity within the plantation monoculture will remain low or slow to develop. The value of the planted trees can often be lost and the progression of succession in the understorey may end up being decades behind.

By continuing to thin these plantations on an 8–15 year cycle you can maintain good growth of the canopy trees while providing continuous sunlight to the understorey and forest floor. This gives colonizing hardwoods the room and sunlight they need to grow, and disturbs the soil surface to encourage germinations of seeds. As such, plantations will benefit from adjacent natural hardwood seed sources. Typically under these conditions a dense diverse tree seedling layer develops. Where seed is in shorter supply or restoration of hardwood species is more urgent, you may need to consider planting native seeds or seedlings suited to the site, in the canopy gaps. Through a series of successive thinnings, the structural elements such as downed wood, canopy gaps, and diverse vegetation layers develop. Over time, these managed plantations become difficult to distinguish from the surrounding, naturally established woodlands.

When establishing and managing new conifer plantations, land managers may consider modifications to conventional designs that may advance the process of succession. Planting blocks, multiple rows, or even individual suitable native hardwood trees within strategic locations will allow mature deciduous species to occur on the site earlier than they would naturally, and these trees will provide a seed source for the plantation as a whole. Row configuration and spacing can be varied to create more natural conditions. The choice of thinning prescription should consider spacing of residual trees, the amount of light reaching the forest floor, ground disturbance, and variable gap sizes to accommodate different species. Keeping individuals and groups of large mature conifers trees over the long term will retain another rare habitat element that was once more common in the southern Ontario woodland landscape. As with other silviculture systems, efforts within conifer plantations should be aimed at promoting the retention of snags, cavity trees, and other old growth attributes while minimizing the creation of edge habitat.

Colonizing hardwoods — Photo: Ken Elliott

White trilliums — Photo: Al Woodliffe

General Silvicultural Direction for the Common Forest Cover Types of Southern Ontario (Based on OMNR 2000)

Forest cover type	**Dominant species**	**Common associate species**
upland tolerant hardwoods	sugar maple, beech, hemlock, red oak, white ash, red maple, black cherry	black maple, ironwood, basswood, bitternut hickory, white pine, white birch, yellow birch, butternut in Site Region 7E also: white oak, shagbark hickory, hackberry, tulip tree and sassafrass
upland oaks	red oak, white oak, bur oak, and black oak	white pine, sugar maple, bitternut hickory, red maple, white birch, large-tooth aspen, trembling aspen, red cedar, hickories, black cherry, sassafras, white ash, beech and chinquapin oak
lowland hardwoods and swamps	silver maple, swamp (Freeman) maple (red and silver cross), red maple, red (green) ash, black ash, white elm, yellow birch	trembling aspen, balsam poplar, basswood, white birch, white cedar, balsam fir, red elm, black maple, bur oak, butternut, white pine, white ash, sugar maple, large-tooth aspen, willows
pine	white pine, red pine, and/or jack pine	oak species, white cedar, white birch, to a lesser extent, hemlock, balsam fir, red maple, black cherry, basswood, white ash, sugar maple, ironwood
cedar	either red cedar or white cedar	on white cedar sites, white spruce, or balsam fir or white birch and poplar on red cedar sites, red oak, white oak, black oak, white pine, red pine
hemlock	eastern hemlock	sugar maple, yellow birch, white pine, balsam fir, white cedar, red maple
conifer plantations	red pine, white pine, white spruce, tamarack	native species that seed in from surrounding seed trees and stands

Codes:
R—recommended—silvicultural guidelines are available for applying this in southern Ontario
NR—not recommended—there is either not enough experience in southern Ontario or the wealth of knowledge demonstrates that this is a poor practice
CR—conditionally recommended—silvicultural guidelines are available for applying this under certain specified conditions in southern Ontario
* diameter at breast height

Silvicultural system or method					
Clearcut	**Shelterwood**	**Single-tree selection**	**Group selection**	**Stand improvement**	**Crop tree**
NR	CR Risk of exotic invasion should be low	R	CR—should be used more to perpetuate intolerant and mid-tolerant species. Risk of exotic invasion should be low	R—in combination with single-tree selection or crop tree management in degraded or unhealthy stands	R—especially in young even-aged stands
NR	R—most commonly recommended to develop even-aged, high composition of oak —needs follow-up	CR—does not maintain growth of mid-tolerant seedlings	R—develop patches of oak regeneration-continuously maintains high forest canopy—needs follow-up	R—in combination with shelterwood, group selection or crop tree management in degraded or unhealthy stands	R—especially in young even-aged stands
CR—provided site protection, aesthetics, hydrology, regeneration, and tree conservation by-law concerns have been addressed	CR—significant blowdown potential with shallow-rooted species	CR—if limited tolerant species also consider using some group selection	CR—usually needs monitoring and possible follow-up regeneration or tending work	R—in combination with any of the other recommended approaches	R—especially in young even-aged stands
CR—where aesthetics, ecological objectives, and tree conservation by-laws permit	R—most commonly recommended for regeneration of mature white and red pine stands	CR—where component of hardwoods approaches 50% or more	CR—for establishing or releasing hardwood or pine regeneration	CR—except in degraded stands or ones with health issues	R—especially in mixed stands or younger plantations
CR—where aesthetics, ecological objectives, and tree conservation by-laws permit	CR—for small white cedar stands or using red cedar to protect hardwood regeneration	CR—for continuous cover using light thinning targets	CR—no more than 20% of stand during any cutting period	CR—in middle-aged (50 to 80 years) white cedar stands —thinning from below	R—in red cedar CR—in white cedar later years (80+), as lead—up to shelterwood
NR	CR—in stands with no potential for development of mature stems and no regeneration	CR—for mature stands > 24cm dbh*	R—gaps of half the canopy height	CR—in stands up to 24cm dbh and at least 16m^2/h BA	R—especially in polewood stands
CR—where aesthetics, ecological objectives, and by-laws permit—especially where native species become well established	R—commonly recommended as nurse crop for hardwood or conifer regeneration	CR—where component of hardwoods approaches 50% of more	CR—for establishing or releasing hardwood or pine regeneration	R—during early thinnings or anytime when there is a high proportion of unhealthy stems	R—especially in young plantations or ones with considerable health or form issues (i.e., weevil damage)

Male Yellow-bellied Sapsucker — Photo: Daniel Cadieux

"There is nothing in which the birds differ more from man than the way in which they can build and yet leave a landscape as it was before."

Robert Lynd

Female Pileated Woodpecker —Photo: Robert McCaw

HARVESTING EFFECTS ON BIRDS

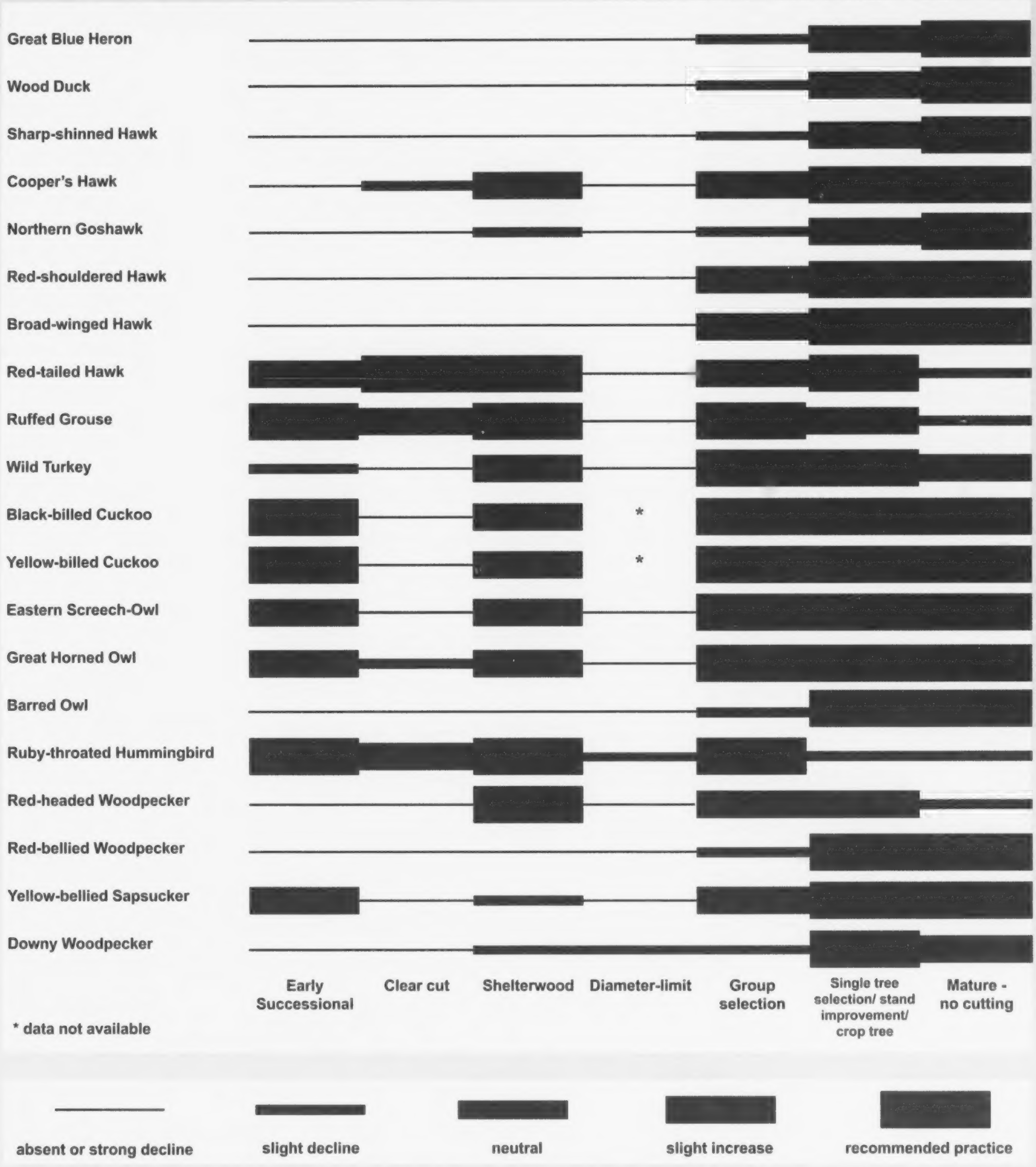
This section provides a description of the general impacts of forest harvesting on birds. To assist managers we have developed a table of specific bird species responses to forest management practices (see *Bird Response to Forest Management Practices* on pages 50–53) along with the bird species accounts (starting on page 99) which will assist both in identifying birds and describing their habitat and management preferences.

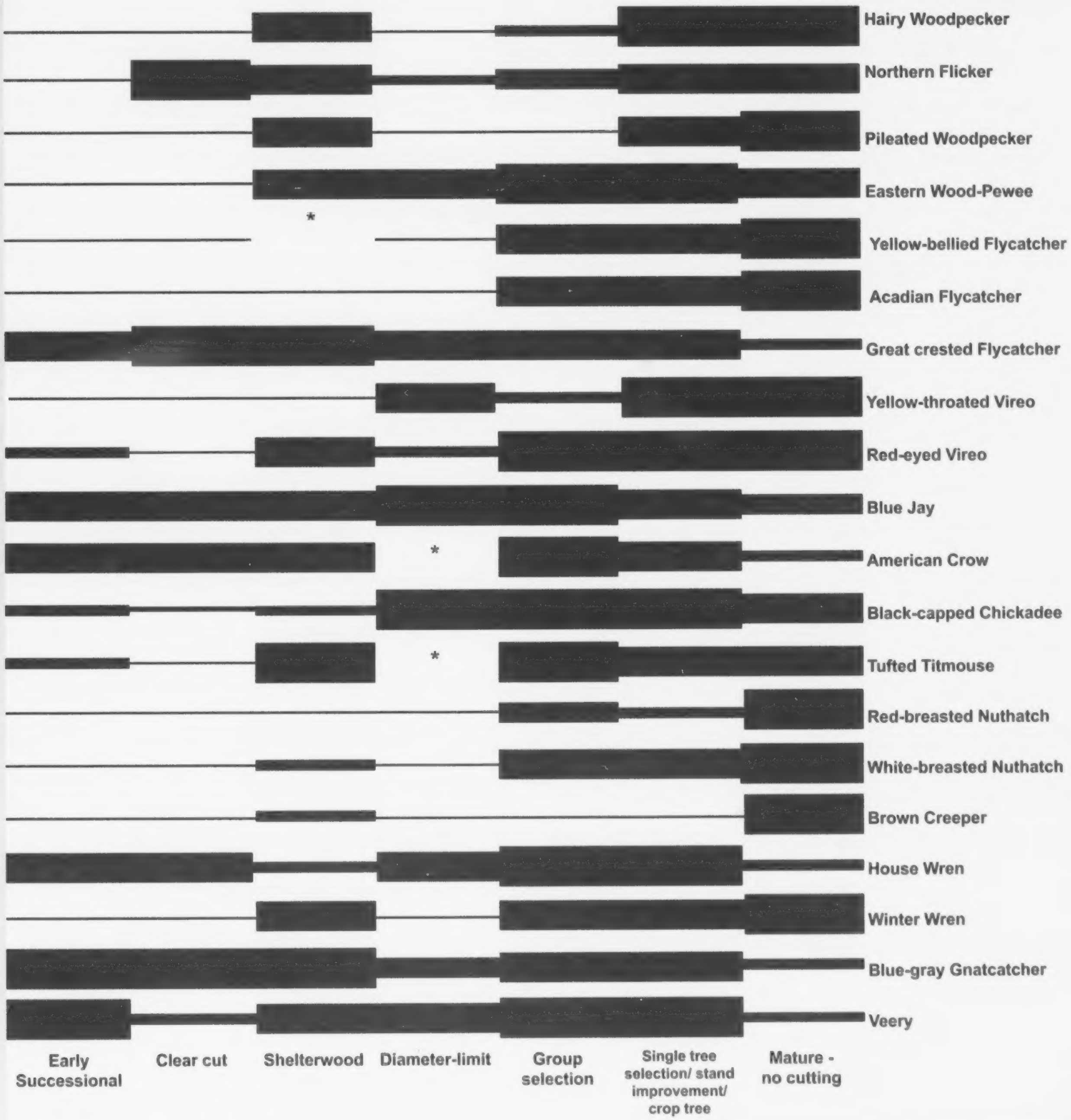
Abundance and Diversity

The effect of tree harvesting on birds depends not only on the species in question but also the intensity and size of the harvest compared to the surrounding landscape. Clear cut harvesting (where the canopy is completely removed) results in nearly a complete turnover of the bird community, particularly when the clear cut is large. The climate will shift from one that is relatively moist, cool, and dim to a warmer, brighter, drier, harsher environment with greater daily changes in abiotic (non-living) conditions. Mature forest birds will not thrive in a clear cut, and species like Eastern Wood-Pewee, Ovenbird, and Acadian Flycatcher will abandon these stands for a decade or more. As the new regenerating vegetation grows, birds requiring early successional habitat, like the Blue-winged Warbler and Indigo Bunting will appear. When the canopy begins to grow and close in (approximately 10 years post harvest), more forest dependent bird species return. However, it may take 35 to 45 years for forest interior or mature forest birds to re-inhabit an old clear cut. In contrast, shelterwood harvesting may retain sufficient canopy cover to prevent the initial loss of many mature forest bird species. Still, the abundance of many of these species will be lower than on uncut or selectively logged stands. The number of bird species is often greatest on shelterwood stands after the regeneration cut, because both mature forest and early successional habitat are available.

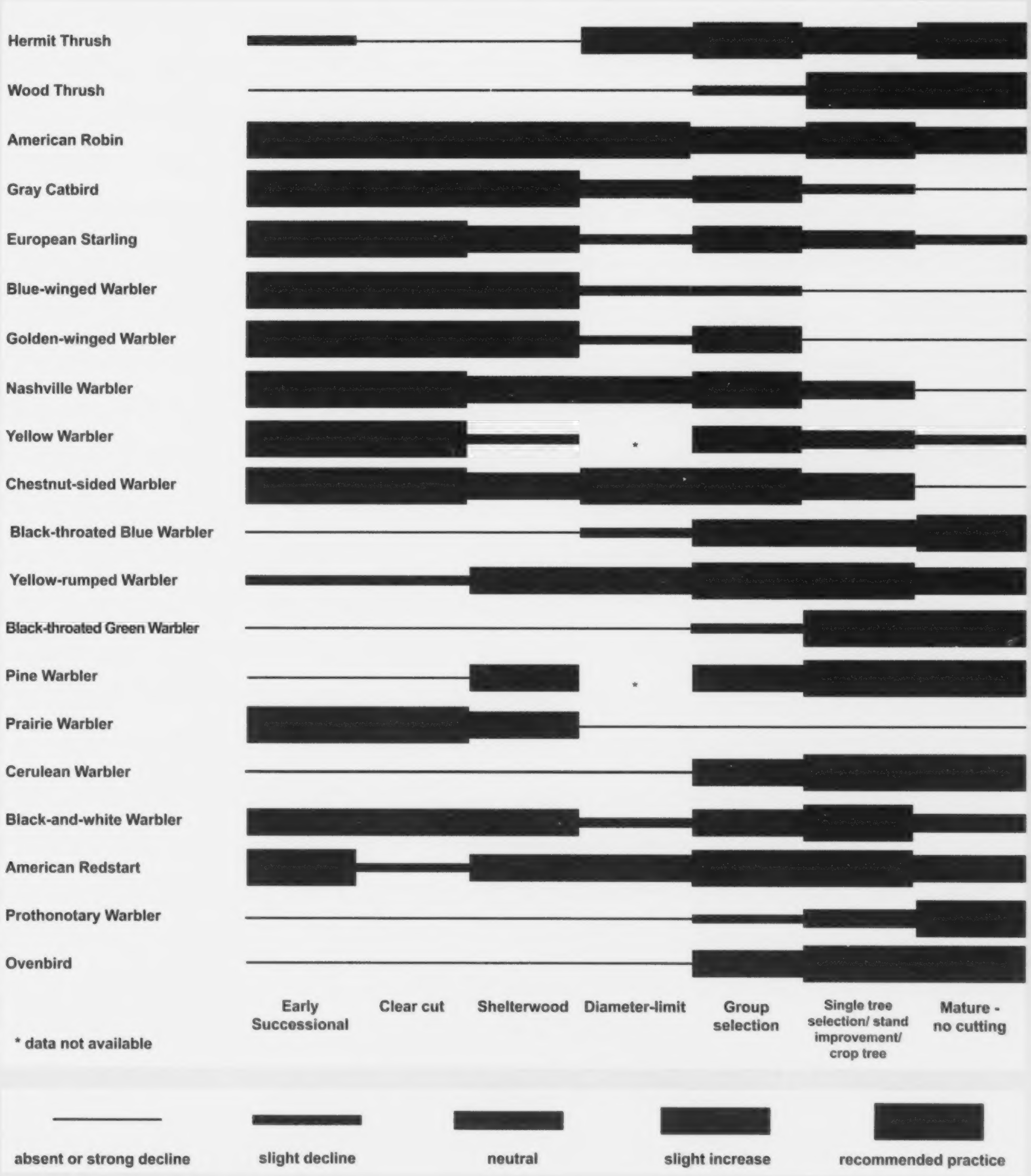
Early successional habitat (Chestnut-sided Warbler nest site) — Photo: Mark Peck

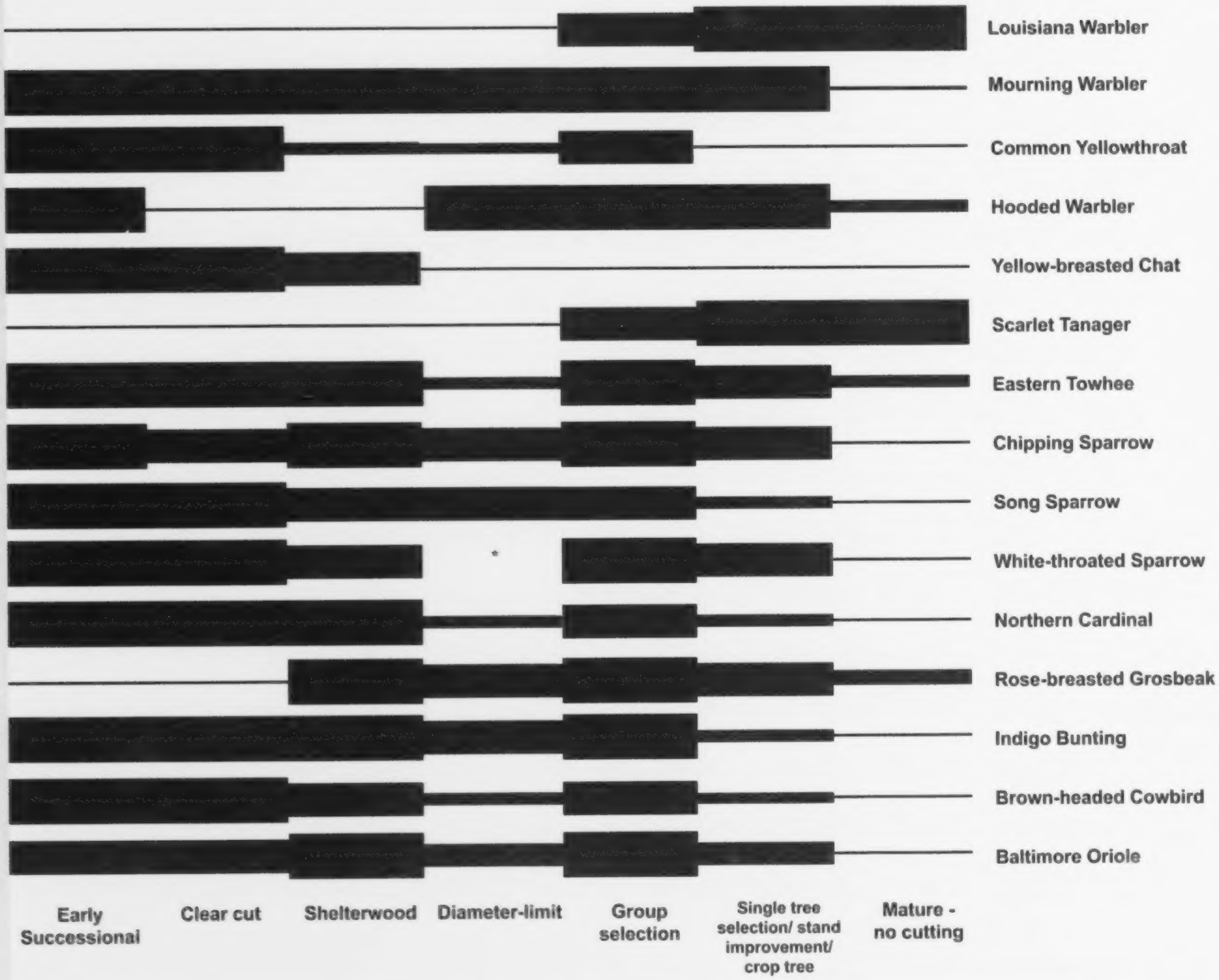
Bird Response to Forest Management Practices




Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Eastern Wood-Pewee
Yellow-bellied Flycatcher
Acadian Flycatcher
Great crested Flycatcher
Yellow-throated Vireo
Red-eyed Vireo
Blue Jay
American Crow
Black-capped Chickadee
Tufted Titmouse
Red-breasted Nuthatch
White-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Blue-gray Gnatcatcher
Veery
*
*
*
Early Successional
Clear cut
Shelterwood
Diameter-limit
Group selection
Single tree selection/ stand improvement/ crop tree
Mature - no cutting

Bird Response to Forest Management Practices





Female Black-throated Blue Warbler on nest – Photo: Lucas Foerster

Wood Duck nestling in nest cavity — Photo: Terry John Myers

Male Brown-headed Cowbird — Photo: Brandon Holden

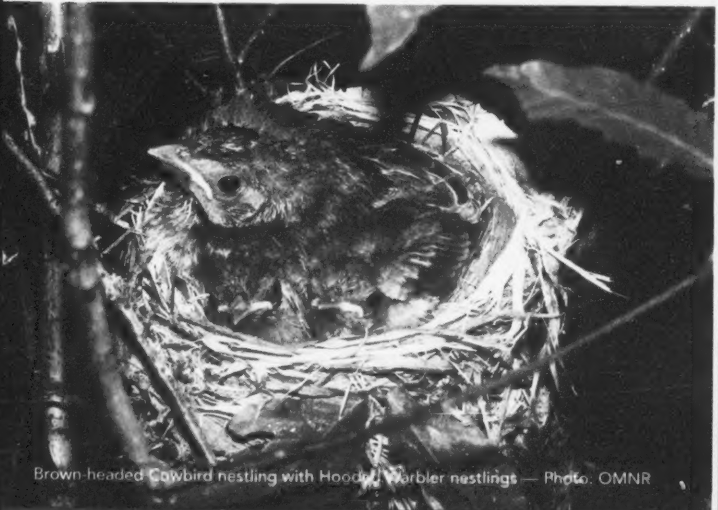
Selection system harvesting causes more subtle changes in vegetation structure than even-aged management and retains a forest bird community similar to uncut mature forests. Gap-dependent species, such as the Hooded Warbler and Chestnut-sided Warbler increase. However, species that depend on dead and declining trees like cavity nesters, or species like Brown Creeper that depend on large mature trees can suffer after selection or diameter-limit logging, since harvesting removes many of these trees. If the group selection method is used some species like the Wood Thrush, or area sensitive forest interior species (Acadian Flycatchers) may disappear because of the large gaps and perceived changes in habitat structure within their historic territories.

Diameter-limit cutting removes most, if not all of the large trees, and although it retains canopy cover, stands are often more open and less dense (30–60 percent basal area removal) than selection harvested stands (20–30 percent of basal area removed). Habitat for shrub layer dependent species (Indigo Bunting, Chestnut-sided Warbler) and generalist species (American Redstart, Brown-headed Cowbird) is often increased. However many species are negatively effected; Brown Creepers and species of conservation concern (Acadian Flycatcher, Cerulean Warbler) tend to be absent from heavy cut stands, while primary cavity nesting species, like woodpeckers, are sparse due to loss of preferred nesting and feeding habitats. (See *Bird Response to Forest Management Practices* pages 50–53.)

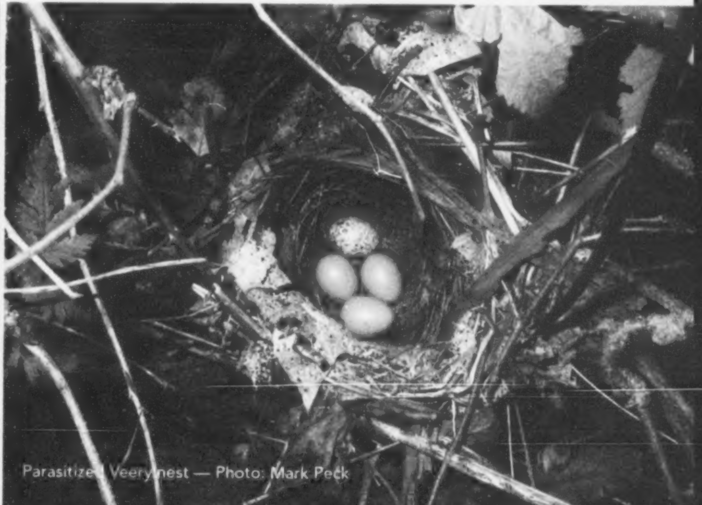
Productivity

In landscapes fragmented by agriculture, Brown-headed Cowbirds and nest predators can be abundant, and compromise the survival of songbird nests. Logging can compound existing stresses by increasing openness in the canopy and changing forest structure to allow predators and parasites greater access to forest bird nests. Brown-headed Cowbirds are more abundant in clear cuts, shelterwood, and diameter-limit cut stands than in unharvested or in single tree selection harvested forests. For example, in diameter-limit cut stands, not only does the number of nests that are parasitized increase, but also intensity increases. Cowbirds parasitize a greater proportion of nests and lay more eggs in each nest. Though parasitism rates can increase in the fragments of southern Ontario following single tree selection, rates of parasitism are similar to or lower than in uncut forests five or more years after harvest. Predation rates, on the other hand, are more variable between harvest treatments, but tend to be higher on heavily cut sites.

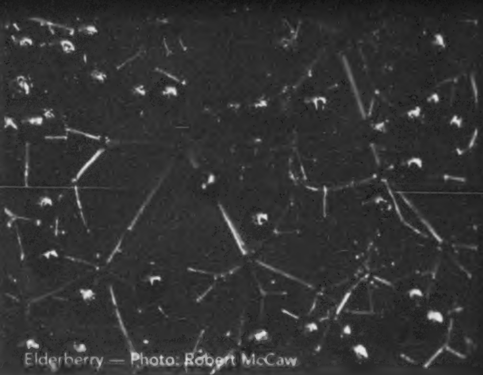
Overall, the impact of parasitism and predation on birds nesting in recently harvested forests is species specific, because each species of bird responds slightly differently. Forest interior species like Hooded Warblers that are victims of Brown-headed Cowbird parasitism, suffer reduced nesting success when partially cut forests are invaded by cowbirds. For this species, and those like Rose-breasted Grosbeak, heavier cut sites serve as *ecological traps*. High availability of open canopy and dense shrub and sapling layers for nesting attracts these species to these sites. Heavily cut sites become *traps* by attracting high densities of some bird species, who suffer significantly lower nesting success on these sites because of high densities of nest predators or cowbirds. Generalists (species like the American Robin and Northern Cardinal), may not be subject to these same elevated predation and/or parasitism pressures, and therefore experience similar levels of nest success across harvesting intensities. Others



Brown-headed Cowbird nestling with Hooded Warbler nestlings — Photo: OMNR



Parasitized Veery nest — Photo: Mark Peck


Elderberry — Photo: Robert McCaw

like the Wood Thrush will respond positively to the structural changes associated with low intensity selection system harvesting and have higher nesting success in these sites. However, this benefit does not occur until at least five years after harvest, but can persist for a number of years (5–10 years).

Predation and parasitism are not the only changes associated with harvesting that can affect avian productivity. Reductions in food availability can strongly influence a parent's ability to feed its nestlings. This can result in fewer young or less healthy young produced by the pair of birds. Research shows both Northern Cardinals and Rose-breasted Grosbeaks fledge fewer young per nest in diameter-limit sites than uncut sites. This may be due to lower food availability, increased parasitism (as cowbirds typically remove a host egg), or both. Virtually all songbirds eat insects and other invertebrates during the breeding season. When you open up the canopy by harvesting, a forest becomes sunnier, hotter, and drier. This can reduce the biomass of insects that are vulnerable to desiccation. The changes in micro-climate can be extreme as the intensity of harvest increases, and translate into larger changes in forest structure and insect communities. Reductions in the density of mature trees can result in less bark and canopy dwelling insects available for canopy and bark feeders. In selection system harvests where you retain most of the mature canopy and the abiotic environment changes little, insect communities will be more similar to uncut forests. Flying insects, on the other hand, can respond positively to abiotic changes created by canopy gaps, and thus group cuts can create ideal foraging habitat for aerial insectivores, such as flycatchers. As insects are not the only source of food, changes in forest structure and composition may alter availability of fruits and seeds. Growth and regeneration of mid-tolerant tree species like red and white oak, bitternut hickory and black cherry through shelterwood or group selection can increase the availability of tree seeds (also known as mast). Similarly, gaps will often stimulate shrub growth, creating new sources of food, like raspberry or elderberry. Thus harvesting can have positive or negative effects on food availability depending on species-specific foraging preferences and the system employed.

Survival of juveniles after they leave or *fledge* from the nest is another key component influencing avian productivity. During the post-breeding period, adults and juveniles of mature forest bird species start to make use of early successional habitats, where an open canopy creates new growth in the form of a dense shrub layer. These habitats offer greater protection from predators, and for some species, high food sources. For species like Hooded Warbler, heavy diameter-limit cut sites may actually have higher juvenile survival rates than single tree selection or unharvested sites. While for other species like Rose-breasted Grosbeaks, harvest treatment has little impact on fledgling survival parameters. Thus, early successional habitats can provide valuable habitat to juvenile birds of some species but do very little for another.

In summary, the intensity of the harvest strongly influences the extent to which harvesting affects bird communities. Even-aged management creates very different breeding conditions and different bird communities, than uneven-aged management. In a continuously forested landscape (like the boreal forest region), even-aged management minimizes many of the dramatic changes associated with harvesting, since the bird species are adapted to infrequent large-scale disturbances. Loss of canopy cover and

Rose-breasted Grosbeak fledglings — Photo: Brad Woodworth

Urban development — Photo: Scott Gillingwater

increased edge is less of a concern in these forested landscapes since densities of nest predators and parasites do not increase after changes in the surrounding habitat, as is the case in agricultural landscapes. It is important to remember that the impact of management in a particular stand is not isolated. These changes could deter or increase bird populations in adjacent patches. When the larger landscape is diverse, birds can move to adjacent stands where habitat is suitable if temporary loss of their preferred habitat occurs through harvesting.

In southern Ontario where mature and old growth conditions are rare, and the forest is broken into small, disconnected pieces, diameter-limit harvesting proves to be inadequate at preserving ecological function and diversity. Not only are diameter-limit cuts poor at growing trees and maintaining healthy diverse forests, but they also create unsuitable habitat for many breeding birds. Using the selection system is a practical alternative, as it will retain and create habitats more similar to old growth and unharvested forests. Applying group selection while retaining uncut areas in a forest can be a good management option. This preserves mature habitat while creating patches of early successional habitat that benefits a diverse group of species. Using a variety of harvesting methods, including preserving patches of old growth forest at the landscape level will provide habitat for the most species during all stages of the breeding cycle. No forest in isolation can provide habitat for all the species the landscape supports.

Small disconnected pieces of forest in southern Ontario — Photo: Scott Gillingwater

Male Northern Flicker in cavity with nestlings — Mark Peck

Woodpeckers — Fungi — Harvesting

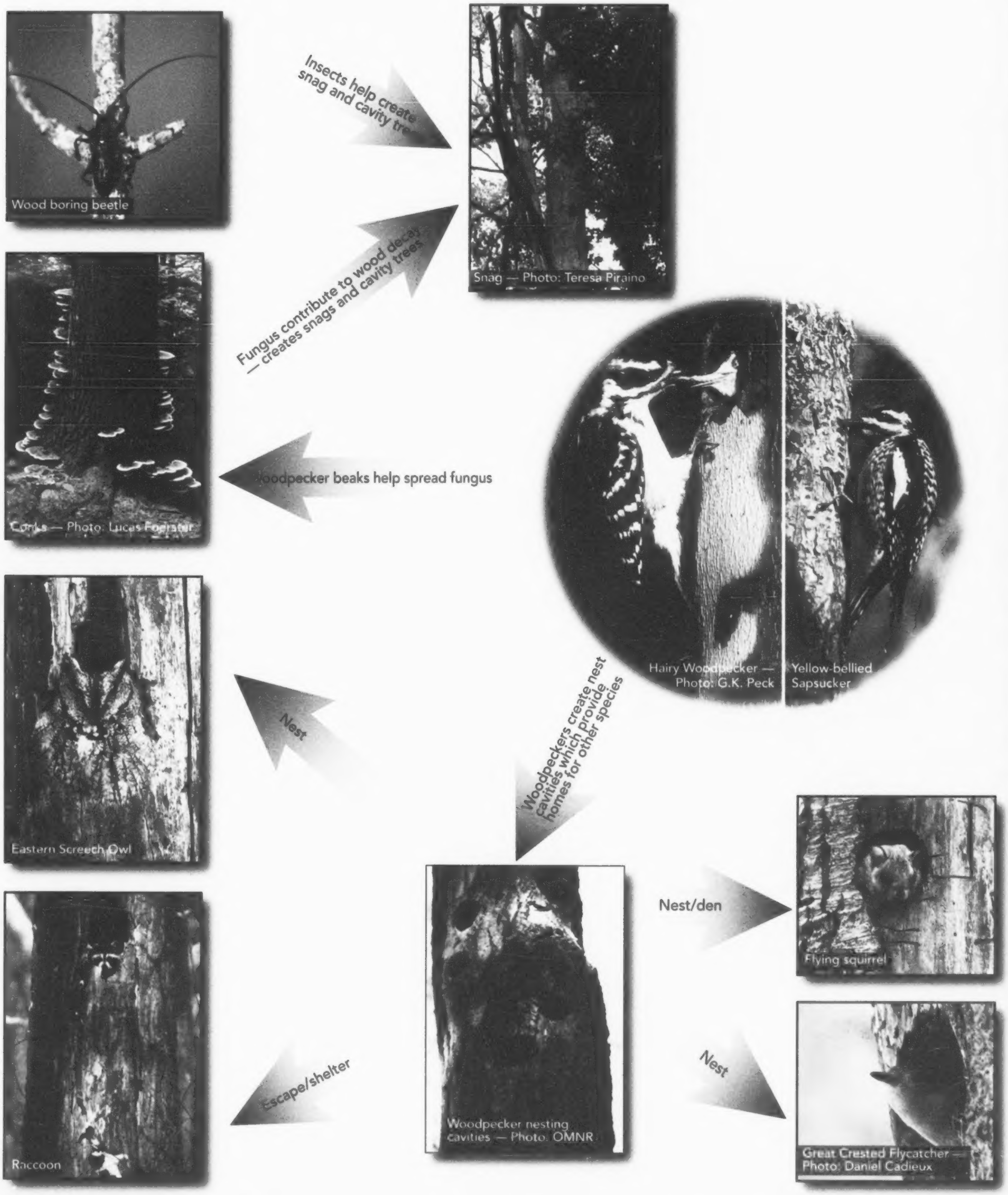
Woodpeckers often choose nest sites in dead or partially dead trees. The ideal tree for cavity breeders has a hard outer shell (*bark*) that protects the nest against predation, and a soft decaying inner core, that makes excavation easy. Fungi that target the heartwood of living trees but do not affect the outer sapwood create trees that fit these criteria. Fungi spores enter the tree through wounds or exposed wood scars caused by broken branches, frost cracks, lighting strikes, or logging damage. The fungi grow into the heartwood of a tree and may rot the core for decades spreading up and/or down the centre of the tree. After decay has progressed in the tree for a number of years fungi appear as conks or mushrooms on the sides of the tree. In some species like oaks, these conks are rarely visible even when trees have undergone severe decay. A healthy vigorous tree will have the ability to restrict the spread of the rot to a localized area. Recent evidence suggests that a woodpecker's bill is a microcosm of fungal spores that play a key role in the decay of dead trees, or *snags*. Many cavity nesters are shown to have a variety of wood inhabiting fungi living in their beaks. Woodpeckers initially puncture dead and dying trees in search of bark beetles and other wood boring insects, thereby creating holes in wood that serve as infection sites for airborne fungal spores. As the birds return to these holes to feed or to excavate them further for nesting they pick up the fungi in their beaks. They help spread the spores by foraging on other trees. These fungi serve a critical role in the decomposition of trees and influence how they are used by wildlife. Without adequate decay, woodpeckers are unable to excavate nest cavities—which serve as vital components of forests as nesting or denning sites for a large variety of wildlife.

Land managers often target snag and declining trees with evidence of heart rot for removal. The removal of this critical habitat during selection harvest reduces the abundance of woodpeckers on logged sites. By retaining some existing cavity trees and snags as wildlife trees, where safely possible, you will help to maintain habitat for a whole host of species.

Northern Flicker ejecting woodchips from cavity — Photo: Peter Burke

Artist's conk on sugar maple tree — Doug Tozer

Why are woodpeckers so important?



Wood boring beetle

Insects help create snag and cavity trees

Snag — Photo: Teresa Piraino

Fungus contribute to wood decay — creates snags and cavity trees

Conks — Photo: Lucas Foerster

Woodpecker beaks help spread fungus

Hairy Woodpecker — Photo: G.K. Peck

Yellow-bellied Sapsucker

Woodpeckers create nest cavities which provide homes for other species

Nest

Eastern Screech Owl

Woodpecker nesting cavities — Photo: OMNR

Nest/den

Flying squirrel

Nest

Great Crested Flycatcher — Photo: Daniel Cadieux

Escape/shelter

Raccoon

All photos Robert McCaw except the ones noted.

Cedar Waxwings

Mourning cloak butterfly

Woodpeckers create feeding cavities (i
sapwells) that provide food for other species

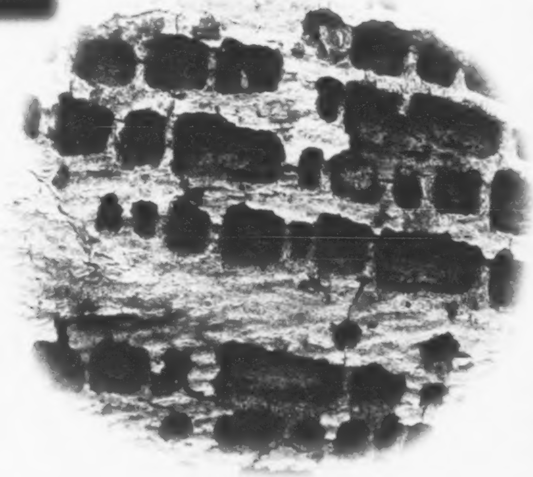
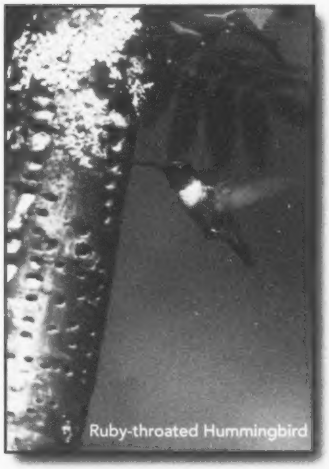


Photo: Lucas Foerster


Ruby-throated Hummingbird

Red squirrel

Woodpeckers, like the Yellow-bellied Sapsucker, are believed to operate as keystone species. The very presence of these species contributes to a diversity of life. Keystone species help to support the entire community of which they are a part. Loss of a keystone species would consequently lead to the extinction of other forms of life that depend on the resources or structures they create or maintain.

"When one tugs at a single thing in nature, he finds it attached to the rest of the world."

John Muir

Photo: Lucas Foerster

> "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."
>
> **Aldo Leopold**

Photo: Doug Tozer

GUIDELINES FOR FOREST MANAGEMENT AND MAINTENANCE OF FOREST BIRD DIVERSITY

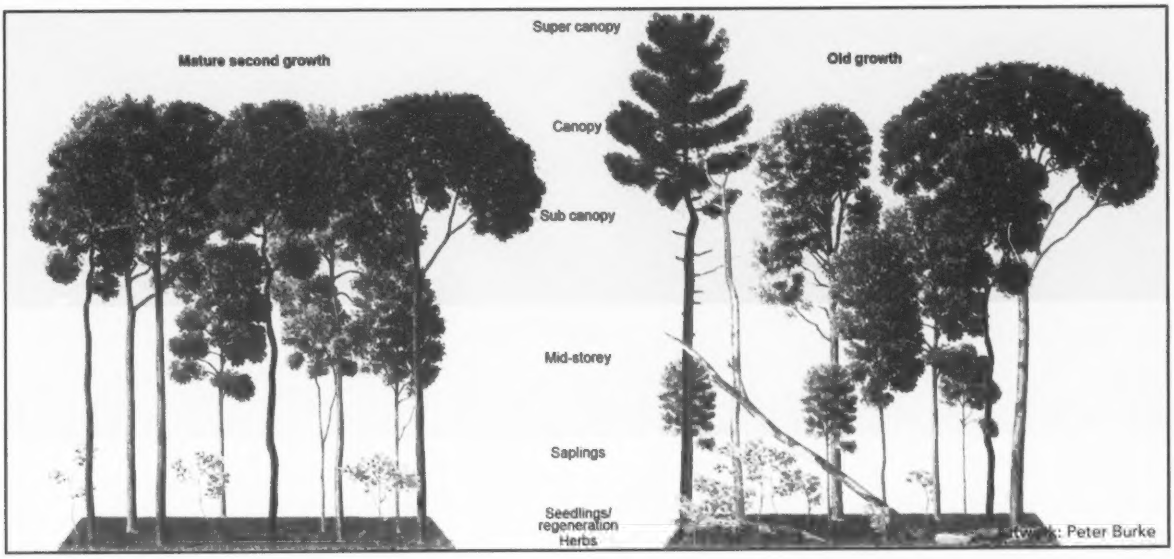
Given all the factors that influence the quality of a forest, determining the best management options for a woodlot can seem like an overwhelming task. We know that much of our biodiversity is resilient to disturbance, both natural and human. It is believed that thresholds exist in nature, beyond which the systems ability to recover or rebound is lost. In most cases, we do not know where these thresholds lie. In their place, we try to manage in a way that mimics natural disturbance regimes, recognizing that these lie within the system's limit. The further our management patterns diverge from natural regimes in frequency, intensity, extent, or any combination of these, the greater our risk of jeopardizing some components of biodiversity.

Landowners ultimately have the power to maintain or enhance stand quality, mainly with appropriate silviculture practices based on site and forest characteristics. We recommend seeking advice from a professional forester, which can increase economic return in the end. Below is a list of 15 key management guidelines to incorporate into your forest management plan to maintain and enhance forest habitat for biodiversity and other ecosystem values and functions.

1. Preserve unaltered habitat

Old growth forests tend to have structurally more diverse habitats with a variety of features and unique microhabitats that are often absent from younger second growth forests (see *Old Growth Features* page 63). These features provide habitat for 46 bird and mammal species in southern Ontario that prefer old growth habitat. These habitats are now rare in southern Ontario, as most were removed by logging, forest fires, and European settlement by the early 1900s. Preserving existing tracts or allowing a forest to succeed naturally into old growth is the simplest and most effective way to restore this component into the current landscape. Woodlot owners

Differences in Structural Diversity Between Mature and Old Growth Forests



twork: Peter Burke

Yellow lady's slipper — Photo: Robert McCaw

using passive management will produce the most natural appearance and old growth conditions in their woodlots in the future (i.e., no cut stumps or skid trails), because no trees are cut using this approach. Nonetheless, developing an old growth structure using passive management can take over a century in eastern deciduous forests, when you consider natural tree growth and natural disturbance patterns. While passive management means no human intervention, it does not mean do nothing. Since the time frame for developing old growth characteristics is beyond your lifetime, engaging in forest and estate planning is critical to achieving old growth structure in your forest.

Preserving unaltered habitat can also be useful for retaining specific wildlife features, habitat, or landscape elements that are either in short supply or difficult to create through management. Leaving no-cut reserves within a woodlot can also help preserve unique habitats, at a small scale. Limiting cutting within the woodlot core can help protect forest interior conditions and habitat for area-sensitive birds. Buffering around rare plant communities, vernal pools, riparian areas, snags, cavity trees, and stick nests can ensure harvesting activities do not contribute to further declines of sensitive species.

Land managers should be aware that in preserving unaltered habitat there is a chance that ice storms or major wind events set succession back to an earlier stage. This is a natural part of the process.

2. Increase old growth features and conditions in managed forests

Stewardship activities benefit many specialist species. Today's forests support more deer and Blue Jays but they provide fewer homes for Southern flying squirrels or Brown Creepers. Restoration is a long process, and land managers may not see the benefit, though immense, for generations. Many of the following management recommendations aim to encourage land managers to restore older growth features to our landscape.

Today, virtually all old growth forest that remains in southern Ontario consists of small tracts of land (4–40 hectares) that resulted from private family preservation for aesthetics, hunting, or timbering. While these tracts pale in comparison to historic old growth forests, they remain a vitally important resource. Leaving some stands to remain on the landscape as old growth reserves remains a key management goal. However, there are a variety of management techniques to increase the prevalence of old growth characteristics on our landscape, particularly in stands with high existing basal area and large, old trees. (See *Methods to maintain or develop old growth features in managed stands* on page 64.) Planned forest management provides the opportunity to accelerate the development of old growth structures and allows for immediate economic return. However, no single attribute, be it tree age, tree size, canopy structure (foliage layers), or species composition, can consistently define old growth; and

Old growth features —Photo: Jarrid Spicer

Barred Owl — Photo: Dan Kaiser

Old Growth Features — Old growth forests often have a variety of features that define these forests:

Photo: Doug Tozer

1. **Trees of great age.** For a forest to be old growth there should be a number of trees of great age. Though there is no definitive agreement as to how old constitutes great age, a reasonable criterion is the existence of trees exceeding at least half of that species maximum attainable age. Thus, in a typical mixed oak forest, trees in excess of 150–200 years old would constitute an old growth condition.
2. **Trees of commercial value.** The presence of large economically important tree species is usually a good indicator that the area was not selectively cut or high-graded. For example, potential old growth forests should contain canopy specimens (preferably from multiple size classes) of black walnut, black cherry, red oak, white oak, tulip tree, or sugar maple.

Photo: Lucas Foerster

3. **Uneven-aged canopy structure.** Trees of all ages and diameters generally characterize eastern old growth forests. These typically exhibit an age distribution where young stems occur at a much higher density than very large, older stems. Small-scale natural disturbances and differential shade tolerance among species will produce this type of structure.
4. **Treefall gaps.** Old growth stands show evidence of many small canopy gaps of one or several trees. These site disturbances create a diverse overstorey and markedly change the understorey microenvironment by varying the amount of light that reaches the forest floor. This results in an uneven-aged canopy structure. Old growth forests typically have multiple layers (3–5) instead of the 1–2 layers found in younger forests.

Photo: Lucas Foerster

5. **Downed logs.** Coarse woody debris should be a prominent component of the forest floor. These downed logs should be from multiple size classes and in various states of decay, suggesting that they are the result of long-term processes and not one single disturbance event. These logs store a considerable amount of the carbon and nutrients present in a stand, serve as seedbeds for other plants, are important in maintaining forest hydrology, and function as important wildlife habitat.
6. **Standing snags.** Standing dead trees are another prominent element of the old growth forest. Snags indicate that trees have reached natural mortality in place. Snags are a vital component of the ecosystem and are important for a variety of species. They are critical habitat for cavity nesters, mosses, lichens, fungi, and many invertebrates.

Photo: OMNR

7. **Pit and mound topography.** Wind thrown trees often dominate the old growth forest floor, creating a rolling topography. When weather or age knock over trees, their root mat rips up the associated soil from the forest floor and creates a pit or depression. As the root mass decays, the soil is loosened and falls into a mound adjacent to the pit. These pits and mounds are important in forest nutrient cycling and understorey diversity, but are not as common in managed forests.

Photo: Ken Elliott

8. **Undisturbed soils.** Old growth forests typically have soils with a thick organic layer and considerable numbers of ferns, mosses, and fungi. Exempt from heavy logging equipment, horses, dragged logs, or grazing livestock, the soils remain free from compaction.
9. **Ecosystem stability.** Most old growth forests approximate a dynamic steady state condition where they exhibit only minor changes. Mortality and decay generally balances growth, and nutrient input is roughly equivalent to nutrient output. Since most of the nutrients are retained in the plants, and they die in place, nutrients remain on site. In contrast, two or more back-to-back clear cut rotations will deplete many eastern soils of nutrients.

Red eft — Photo: Teresa Piraino

10. **Diversity of plants and animals.** In addition to the above-mentioned abundance of ferns, mosses, and fungi, old growth forests often have a higher diversity of understorey herbs, particularly in hardwood stands. This may not be the case in some old growth softwood stands (eastern white cedar) because of the decreased light and highly acidified soils. There is also a variety of animals associated with the structural elements of old growth stands. You can often find a greater abundance of certain species of salamanders, small mammals, soil invertebrates, and songbirds in old growth stands compared to younger stands.
11. **Little or no evidence of human disturbance.** Presently, we do not classify stands with obvious signs of significant human disturbance as old growth. This includes logging, livestock grazing, past agricultural, or residential use.

Downed woody debris — Photo: Ken Elliott

Methods to maintain or develop old growth features in managed stands

1) Forests of great age — uncut patches of legacy trees and tracts of old and older growth forest

- retain entire uncut patches or stands with a diversity of species, sizes, and quality; including snags and cavity trees
- provide for future old growth by maintaining snags, downed woody debris, and permanent patches of legacy trees adjacent to existing old growth features

2) Trees of marketable value — larger and older living trees

- maintain some basal area of large and extra large healthy trees that will survive over the long term
- in sites with old growth potential or features, retain higher basal area target of 24–27 m^2/ha
- target 1–2 trees/ha to retain and allow to grow beyond 80 cm diameter at breast height (dbh)
- increase growth of some of the large, healthy trees by allowing for full or partial crown release of longer lived tall tree species such as white oak, sugar maple, and white pine over early successional species such as birch and poplar
- look to retain trees with potential to become supercanopy trees

3) Broken canopy structure — increased diversity of tree sizes and ages

- harvest small groups or single trees
- repeat on an 8–15 year cycle to increase diversity of ages
- log carefully to avoid damaging small trees

4) Downed logs — increased amount of decaying large logs and woody debris on the ground

- do not remove or destroy existing fallen trees, branches, stumps, or snags felled during logging
- select unhealthy large and medium trees to fell and leave on the ground

5) Standing snags and cavity trees — greater number of large standing dead trees

- maintain as many cavity trees and snags as possible
- harvest only those standing dead trees that are a safety hazard
- where snags are felled, leave these on site to operate as downed logs
- where safe, create snags through girdling selected medium and large trees

6) Treefall gaps — canopy gaps of varying size and tree density across woodland

- create both small and large gaps (up to one hectare in size), using group selection for larger woodlands to mimic natural patchiness of older growth conditions
- thin between gaps using single tree selection to maintain a basal area of 22–24 m^2/ha to mimic the dominant disturbance of single tree fall gaps

7) Pit and mound topography — maintain natural diversity of forest floor attributes

- allow for dead and dying trees to fall naturally and become uprooted, creating the pit and mound formation common to old growth sites
- these pits and mounds give the forest floor a rugged appearance and provide a great diversity of moisture conditions

8) Undisturbed soils — protect thick organic soils

- reduce the use of heavy logging equipment in sensitive areas to avoid heavy soil compaction
- confine logging in wet areas to frozen ground conditions when the ground is less prone to damage

9) Diversity of plants and animals — keep what you have

- retain and protect mast trees that produce nuts and berries
- protect species at risk at all levels: plants, trees, birds, and animals
- use techniques to promote less common species that were characteristic of historical forests

10) Unique habitats—site specific features such as ephemeral ponds and wetlands

- retain and protect from disturbance small ponds and wet areas in woodlands and any other unique habitats that are not widely available (e.g., stick nests or habitat for species at risk).

Redwoods — Photo: Jarrid Spicer

some features, may be impossible to recreate. Features like a rich organic layer must be left to develop naturally, and can translate into differences in community composition between these managed *old-growth* forests and the original forest, which a century or two of natural succession has created.

Although few fully developed old growth stands remain in private ownership, forest landowners have great flexibility in setting their own management objectives and improving the representation of old growth and older growth features for future generations. Management for old growth may involve control and removal of exotic species, prescribed burning for forest types that require natural disturbance processes for tree regeneration, or designing special harvest plans. Many of the practices used in traditional timber management are also excellent tools for restoring old growth characteristics. You may choose to implement old growth management or restoration, whether it is passive or active, to all or only a portion of your woodlot. When considering where on your land to develop old growth structure, it is most effective to identify and enhance old growth structural characteristics already present in your woods. These areas might include large amounts of downed logs due to a windstorm or a group of large trees containing woodpecker cavities. Considering the *quality*, or the productive capacity of a site, as determined by the amount of available water and nutrients, will enable you to set realistic targets in terms of developing old growth features. Old growth structure will develop faster on high productivity sites than low productivity sites. *Site productivity* is measured by the ability of forest soil to support plants, animals, and microorganisms. Overall, by increasing the network of woodlots retaining these features across the landscape, populations of old growth dependent species will be safeguarded within both actively managed and passively managed woodlands. But remember, there is no one specific old growth condition to aim for as an objective and therefore no one way to create it.

3. Maintain forest structure, manage for uneven-aged canopy

Uneven-aged management methods like single tree and group selection that promote growth and maintain a diverse canopy structure are preferred over diameter-limit. By creating a mix of small and large canopy openings through logging, you can mimic natural disturbance patterns and increase patchiness across the stand, moving towards the complex vertical and horizontal structure of old growth. Old growth forests are defined as structurally and biologically complex, multi-aged, with a multi-layered canopy and are patchy in appearance. Small canopy gaps created by single tree falls are mixed in with fewer, larger openings created by wind, fire, disease or ice storms that give mid-tolerant and intolerants the chance to become established. Managers can create a more varied forest, typical of old growth, by creating gaps through harvesting. Cutting larger openings, like those used in group selection, can create habitat for species that are gap dependent, and can create patches of early successional habitat used by juvenile birds. The gaps can increase tree diversity by encouraging the growth of mid-tolerant species. Gap openings favour fruit producing trees and shrubs, like blackberry, elderberry, and chokecherry and can be important food sources for birds in the post-breeding period. However, we do not recommend gaps (particularly large gaps greater than 50 m in diameter), in small forest fragments, less than 10 ha in size.

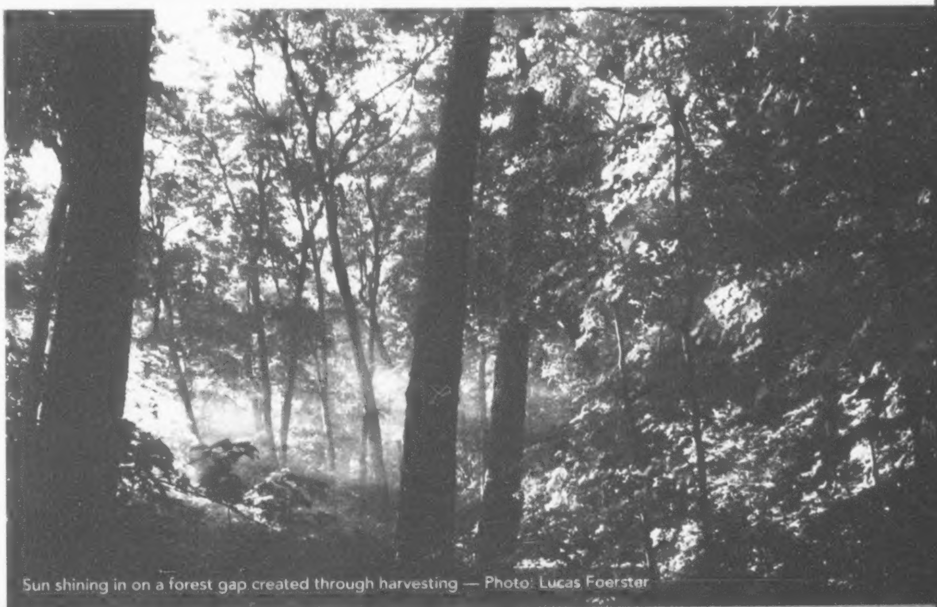

Sun shining in on a forest gap created through harvesting — Photo: Lucas Foerster

Photo: Al Woodliffe

4. Maintain high basal area and leave large and supercanopy trees

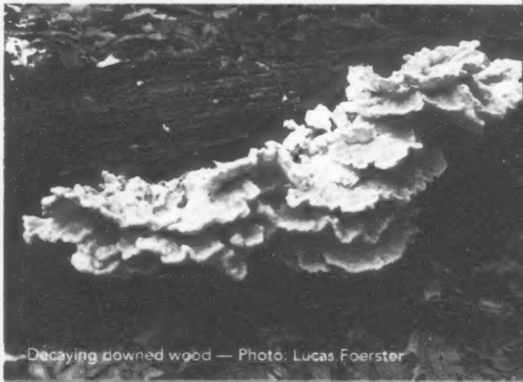
Areas with large, old, mature trees are common elements of old growth forests. Some species of forest interior birds, such as the Brown Creeper, Acadian Flycatcher, and Cerulean Warbler nest in the areas with large diameter trees. You can retain habitat for these species by adjusting single tree selection prescriptions to maintain sections with high basal area and more large trees (greater than 50 cm dbh). Preserving large diameter declining trees alone or in clusters will conserve quality nest sites for cavity nesting birds and species like Brown Creeper that nest in large old trees with peeling bark. We recommend that you leave at least three large trees (50 cm dbh or bigger, where possible) per hectare, particularly longer-lived species that can attain heights above the main canopy such as white oak, sugar maple, or white pine. Trees that project above the canopy, called *supercanopy trees*, are important for nesting, perching, and as sentinel trees for a number of birds and mammals (particularly hawks and eagles). Aim to retain at least one of these large trees per hectare to meet the criteria of a supercanopy tree.

5. Encourage growth of native plant species and diverse vertical structure

Forests with greater plant diversity and structure will have more microhabitats for breeding, nesting, and refuge, thereby supporting a greater number of bird species than forests dominated by few plant species or with simplified vertical structure. Thinning in plantations will allow sunlight to reach the floor and can encourage the development of herb and shrub layers. You can encourage the growth and abundance of native understorey species by carefully planning skid trails and restricting disturbance to the winter season when frost and snow protect the ground. Ensure that logging equipment entering your woodlot is clean so that skidders are not transporting seeds of invasive species to your stand. Simply maintaining conifer elements in hardwood-dominated stands or deciduous elements within conifer stands is one strategy to increase biodiversity.

Large mature American beech — Photo: Robert McCaw

Diverse vertical structure — Photo: Dawn Burke



Decaying downed wood — Photo: Lucas Foerster

Photo: Lucas Foerster

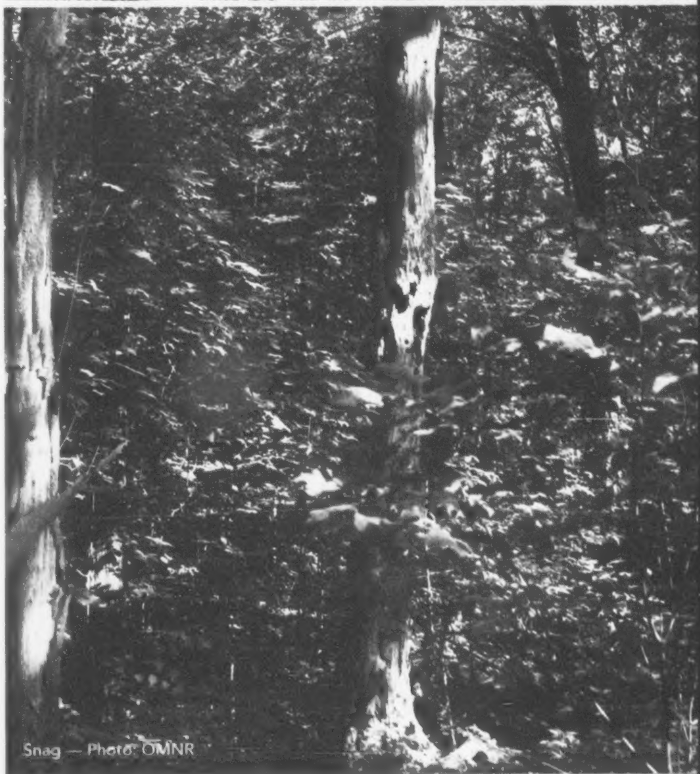
6. Retain cavity trees, snags, and downed wood

Cavity trees are living or dead trees that contain holes used by mammals and birds for nesting, feeding, roosting, or for escape. Cavities can be excavated by woodpeckers during feeding or nesting, or created naturally from decay and broken branches. Over 50 species of birds and mammals in south and central Ontario rely on cavity trees and snags for food and shelter. Some, known as secondary cavity users, like Barred Owls, nuthatches, Wood Ducks, and flying squirrels cannot make their own cavities. They rely on retention of these natural holes or old woodpecker cavities for habitat. Even in the absence of timber extraction, cavity resources can be limited. As both cavity trees and holes are reused for years by a range of species, it is important for the land manager to retain them as wildlife habitat. We recommended you strive to retain at least 10 living cavity trees greater than 25 cm dbh in each hectare of forest to provide habitat for cavity dependent species. Trees should be selected from a range of species, and with a range of cavity sizes to accommodate the suite of species. Preference should be given to trees with cavities in the upper bole, and if possible from tree species that provide multiple wildlife benefits (e.g., mast producers and supercanopy trees). Nest cavities in particular are the most valuable.

Snags and decayed parts of live trees are an important component of healthy forests. They serve as habitat and a rich source of food for birds that drill into wood or flake bark to find insects. This food source may be especially important during the winter for non-migratory species, when food is scarce. Snag retention guidelines can be difficult to attain during harvesting operations, as any trees that are a safety hazard must be cut down. The retention of a snag may require a tree length no-cut buffer around it to protect the forest workers. Ideally managers should leave at least five snags per hectare, and more where possible. At least one snag and one cavity tree should be large (greater than 50 cm dbh). Snags will also become critical habitat in the future, as they fall over naturally, increasing volumes of decomposing wood.

Downed woody debris (DWD) is not only an important source of food for birds, but a critical component of the forest ecosystem, providing habitat for salamanders, reptiles, insects, bacteria, and fungi, aiding in nutrient cycling, and creating structural diversity important for the regeneration of many tree and plant species. In addition to an overall reduction in the volume of DWD in managed stands, there is a shift

Female Wood Duck at cavity nest — Photo: Jeff Nadler



Snag — Photo: OMNR

Photo: Robert McCaw

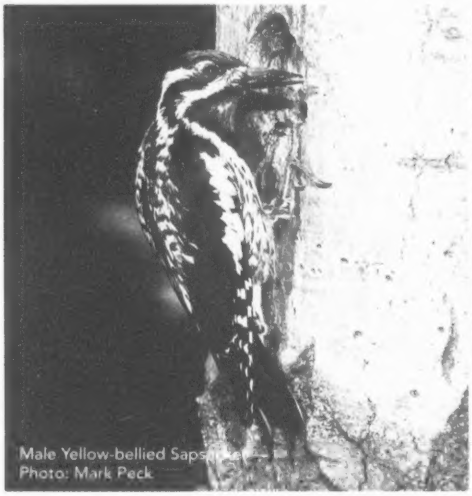
towards small, harder pieces of wood and a lack of high quality, large diameter, decayed DWD. Harvesting operations should be conducted to reduce damage to existing downed wood and organic matter, and avoid the removal of existing downed logs. Processing of tops, branches, and log butts should happen at the felling location rather than at landings and roadsides. Managers should strive to accumulate a collection of fallen logs, either from naturally falling snags and cavity trees, or purposely felling trees to remain as downed wood on each hectare of forest. The larger logs of 60 cm or more in diameter and at least 2 m in length are more valuable and have been shown to build up to as many as 10 or more per hectare in natural old growth stands. If not enough downed wood is present naturally, leaving cut logs on the site every few years can create downed wood in various stages of decay.

Declining tree and snag requirements for primary cavity nesters

Species	**Optimal diameter ranges for nest tree (cm)**	**Minimum nest tree height (m)**	**Minimum territory size (ha)**	**Snags required/ha to maintain 60–100% of population maximum**
Black-capped Chickadee	10–18	1	1	4–7
Downy Woodpecker	15–25	3	2	6–10
Hairy Woodpecker	25–35	6	4	3–5
Yellow-bellied Sapsucker	25–35	6	2	1.5–2.5
Northern Flicker	30–44	6	10	0.75–1.25
Red-bellied Woodpecker	36–53	9	4	4–7
Red-headed Woodpecker	40–60	9	4	3–5
Pileated Woodpecker	45–65	12	70	0.4–1.25

Snags are standing dead trees or parts of dead trees. Primary cavity nesters need these trees for nesting, feeding, and roosting. Studies counting snags usually set minimum standards like being at least 10 cm in diameter at 1.3 m above the ground and being at least 3 m high.

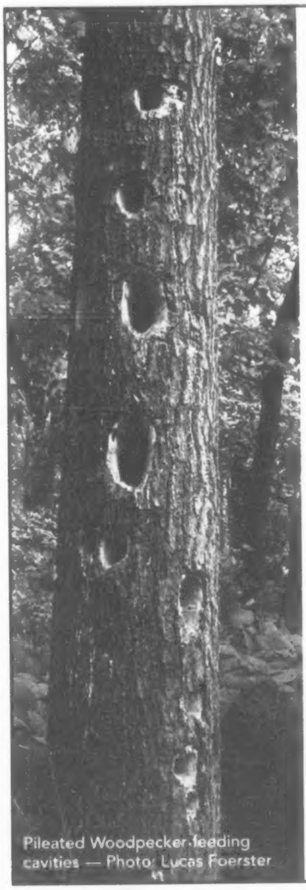
NOTE: Landowner's should strive to keep as many snags as possible from a range of diameters and species.



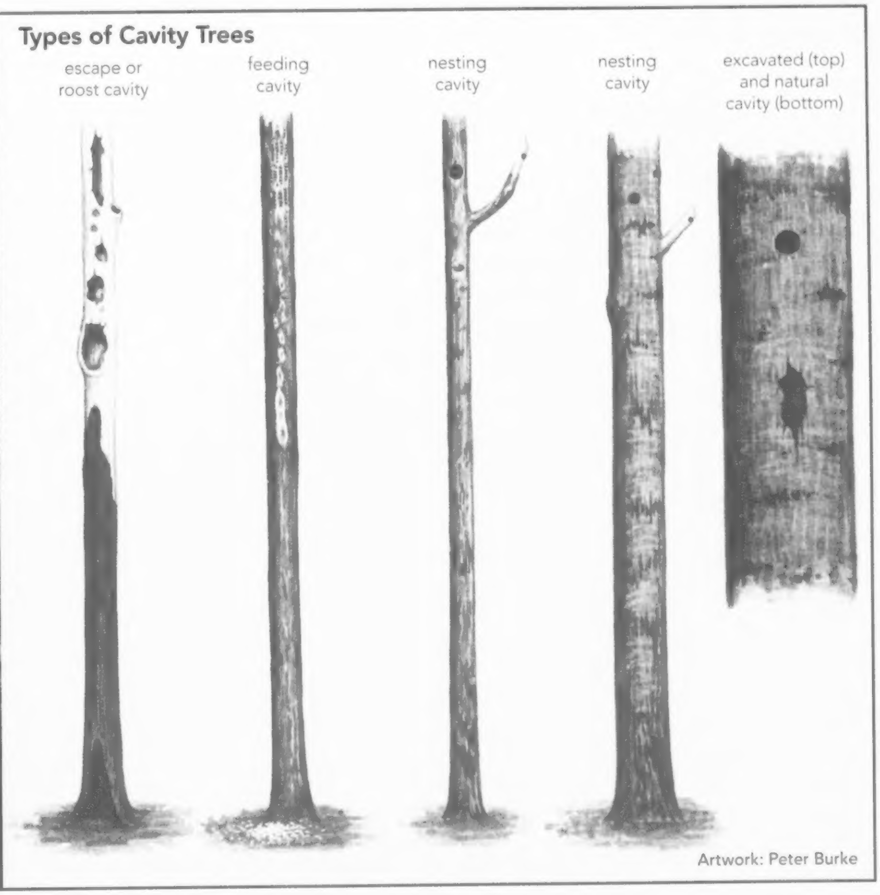
Male Yellow-bellied Sapsucker —
Photo: Mark Peck

Male Northern Flicker —
Photo: Mark Peck

Male Downy Woodpecker —
Photo: Mark Peck



Pileated Woodpecker feeding cavities — Photo: Lucas Foerster



Types of Cavity Trees

Artwork: Peter Burke

Snag and Cavity Tree Safety

The *Occupational Health and Safety Act and Regulations for Industrial Establishments*, defines a *chicot* as a dead tree, or a dead limb of a tree that might endanger a worker. Under that Act, chicots must be lowered to the ground before felling of other trees in their vicinity takes place. In addition, the act requires that employers/ licensees must take every precaution reasonable to protect a worker in the vicinity of dangerous trees such as chicots and certain wildlife trees during non-felling operations (e.g., surveys, planting, maintenance, monitoring).

Vicinity generally means a radius equal to or greater than the height of the surrounding stand. Alternatives to leaving chicots as wildlife trees, in order to maximize worker safety during harvesting operations include:

- Selecting live trees with health issues (conks, scars, seams) for retention, on the basis that they will likely succumb to stress in their post-harvest environment and become suitable wildlife habitat
- Identify live trees that can be killed by girdling or herbicide spraying
- Adopting moderate clumping or grouping of chicots as wildlife trees that can be retained in a "no cut" reserve area, as opposed to having them evenly dispersed throughout the stand.
- For mechanized harvesting operations, a tree can sometimes be topped to become a "stub" that would no longer be dangerous to workers.

The proper selection and distribution of wildlife trees should reduce the potential of creating a dangerous situation for workers during post-harvesting operations, such as tree planting.

Photo: Al Woodliffe

7. Retain stick nest trees and buffers

A number of large bird species (e.g., hawks, owls, ravens, crows, herons) nest in the forests of southern Ontario. These species build large stick nests, typically in a crotch near the canopy of a large diameter living tree. These rare habitat features are used repeatedly and are characterized by large or extra large trees with unusual forks. Guidelines recommend retaining all trees with stick nests and, depending on the species and activity of the nest, a tree length buffer or greater. In woodlots without stick nests retaining at least one large forked tree per 10 ha will ensure an adequate number of future nesting sites for these birds.

Red-shouldered Hawk nest — Photo: Kyle Aldinger

8. Maintain buffers around water features

Ponds, springs, seeps, riparian areas (vegetated areas along streams and rivers), shorelines, wet pockets, and depressions function as areas of critical habitat for many plants and animals. These areas can be particularly sensitive to disturbance. The Prothonotary Warbler, Acadian Flycatcher, and Louisiana Waterthrush are three bird species at risk in Ontario. They are all associated with wet, swampy areas with small pools or streams of open water. Woodland ponds and seeps serve as breeding sites for a number of amphibians. The riparian vegetation is important in maintaining water quality by preventing erosion and silt runoff. We recommend leaving no-cut buffers in and around these sensitive environments. Roads and skid trails should avoid crossing these areas, and avoid choosing trees for harvesting that would fall across these areas. Activities should not fragment habitat or sever travel corridors. Many species, particularly salamanders, are poor dispersers (not mobile). You should maintain high canopy cover to protect water temperature and moisture levels. Where trails need to cross streams or drainages it should be at right angles and minimize disturbance in this area by using culverts or bridges.

Stream through woodland buffered by vegetation —
Photo: Lucas Foerster

9. Limit timing of harvesting activities

Since many forest birds are only in southern Ontario woodlots during the breeding season (April 15–end of August), curbing harvesting activities during this period can minimize disruption to forest birds. As well, harvesting in the winter when a deep snow layer exists can reduce surface disturbance and cause less damage to existing understorey vegetation. As the forest floor is susceptible to disturbance during harvesting operations, soil exposure, compaction, and rutting all work to reduce biodiversity by disrupting the recycling of soil nutrients, reducing ground cover, limiting regeneration, eliminating habitat for soil biota, and creating opportunities for increased soil erosion. In wet areas, harvesting should only occur when ground is frozen or very dry to avoid rutting and soil compaction, which will ultimately affect growth and regeneration of the developing forest. Any partial harvesting program should also avoid the active growing phase (mid-May to late July) when the bark is loose and trees are highly susceptible to damage. In some cases, tree species with light seeds (i.e., yellow birch, red pine) will benefit from surface soil scuffing (site preparation) to allow the seed to sit on mineral soil. Balancing this need for these tree species, while limiting damage to the site would be best accomplished during dry periods in late summer or early fall.

10. Manage exotic invasive plant populations

Invasive exotics pose real threats to the existence of native plants and animals by squeezing them out and destroying their habitats. Non-native vegetation often provides fewer insects for foraging birds, inferior nesting substrates, and competes with native vegetation for resources and space. Garlic mustard, European or glossy buckthorn, common buckthorn, multiflora rose, Japanese honeysuckle, autumn olive, and Dames rocket are a few non-native species that readily invade the woodlots of southern Ontario. Successful exotics may possess dominant biological characteristics that allow them to rapidly invade and out-grow native species for moisture, light, and nutrients. In their native habitats, organisms have natural predators, competitors, and diseases that act as checks and balances. However, when introduced to new areas, these controls may not be in place and problem exotics can thrive, and become pests. Exotics not only displace native species, but they may introduce diseases that native species have no immunity to, create economic costs, destroy wildlife habitat, and even further endanger protected species. Controlling exotic plants is an essential part of preserving and protecting our natural heritage for future generations. Once an invasive exotic becomes established, it can be considerably more difficult to control or eliminate. You can help prevent the introduction of invasive exotic plants by requiring loggers to steam or pressure-wash their equipment before entering your woodlot. Disturbed areas such as landings, trails, and garbage piles can create openings that exotic species readily invade. Avoid creating excess roads, skid trails, and large landings in harvesting operations. Planting these areas with native plants immediately after harvest will help prevent exotics from becoming established.

Skidder stuck in deep mud — Photo: Terry Schwan

Dames rocket an exotic invasive plant species — Photo: Robert McCaw

Logging gap — Photo: Teresa Piraino

11. Manage high deer populations

White-tailed deer — Photo: Larry Watkins

The sight of a white-tailed deer stops most people in their tracks. Even to the most seasoned rural resident, deer are beautiful, interesting, and graceful creatures that represent the wild. In some parts of southern Ontario, high white-tailed deer populations are a big problem. Even to the untrained eye, the absence of plants at lower levels and a razor-straight *browse line* (the maximum height at which deer feed) is an obvious sign of high deer populations. Deer browse on trees and shrubs for food and can reduce understorey vegetation and limit tree seedling regeneration. A forest that is over-browsed is open and park like with an unobstructed view of distant tree trunks, inedible plants, and hardy exotics. Excess numbers of deer render an ecosystem's ability to regenerate virtually impossible. Wildflowers, native shrubs, and tree seedlings have vanished. Without the *herbaceous* (flowers, grasses, ferns, etc.) and woody plants in the forest's lower layers, many birds and wildlife are adversely affected. If your woodland has high deer densities you could consider installing deer fencing (page wire or electrical) or allowing deer hunting to reduce deer numbers and provide an opportunity for your forest vegetation to recover.

12. Manage forest edges, fragment size, and connectivity

Though diversity of plants and animals typically increases proportionately with the amount of edge in a stand, these edge species tend to be habitat generalists. Hard edges, in particular, such as those between a woodlot and a cultivated field can be hostile places for many forest specialists. Various factors control edge effects, including forest size, forest shape, surrounding vegetation contrast (hard vs. soft edges), edge orientation, and species specific responses. You can moderate edge effects by a variety of practices, particularly increasing patch size and managing for compact (square or circular) shaped fragments. Small stands, irregularly shaped, and long, narrow stands with high edge exposure are most vulnerable to outside disturbances. We believe edges are detrimental to some birds because of reduced reproductive success and increased rates of nest parasitism and predation, particularly within 50 m of a forest edge. Allowing forests to naturally seed into

Naturally seeded field adjacent to forest — Photo: Teresa Piraino

Blackberry — Photo: Robert McCaw

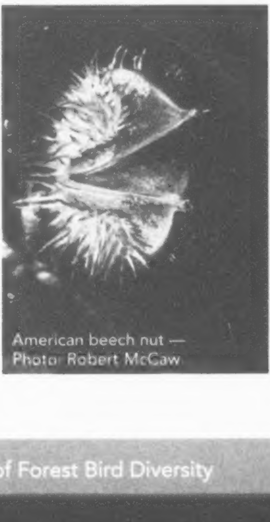
adjacent open fields or planting and maintaining a wider border or buffer around woodlot edges may reduce negative edge effects. You can increase the size of forest fragments or amount of interior habitat by planting trees in large clearings within woodlots, or encouraging natural succession in these openings. If two woodlots are close together, planting in between them to create a larger patch of continuous forest will greatly benefit area sensitive birds in the future. Consideration of which types of species are used for planting and reforestation projects is important. A diversity of native species is best, and matching species to the soil type and light conditions will ensure success.

Conservationists agree that landscape or habitat connectivity is important for, if not critical to, population viability, yet they argue over the value of corridors. Critics of connectors have emerged because so many factors influence corridor use, and creating corridors for the benefit of one species may be detrimental to another. Detailed field studies supporting the benefits of corridors are lacking, and most studies investigating the effectiveness of corridors do not prove that a given species or individual animal is exhibiting corridor specific movements. Also, determining the appropriate habitat structure (e.g., vegetative cover, density, and uniformity), width, and position of the corridor relative to habitat patches in the landscape is challenging. Plus, the effects of these landscape features on many groups of organisms are not well known and depend upon the species, their life history, and the degree of landscape fragmentation. Therefore the inception of wildlife corridor management projects is premature and too costly at this stage. It is important to be aware of sensitive plants and animals located within land management boundaries, particularly those prone to isolation or seasonal disruptions because of limited mobility or range restrictions. Harvests that isolate streams, ponds, vernal pools, deer wintering areas, or other sensitive habitats should be avoided. Where connections and corridors already exist on the land, it is advised to keep this habitat intact. If it's possible, connect two forests with one large block of restored forest; this is preferable to a narrow corridor.

Bur oak mast tree— Photo: Ken Elliott

13. Retain mast trees

Wildlife habitat is composed of three basic elements, food, water, and shelter. The quality, quantity, distribution, and seasonal availability of these three elements will influence the number of wildlife species that your woodlot can support. Different species of trees in your woodlot will provide wildlife with two of the basic elements: food (mast) and shelter (cavity). Mast trees and shrubs are woody plants that produce seeds, nuts, catkins, soft fruits, or berries. These serve as an important source of food for birds and other wildlife and as a seed source for regeneration in order to maintain stand diversity. In southern Ontario, over 75 species of birds and animals consume soft and hard mast from the various shrubs and trees found in your woodlot. Tree species such as oak,


American beech nut —
Photo: Robert McCaw

Red oak acorns —
Photo: Robert McCaw

Photo: Al Woodliffe

hickory, and beech produce hard mast, acorns or nuts. Other tree and shrub species such as birch, ironwood, raspberry, and flowering dogwood produce soft mast, catkins, or berries. Red oak is the most important hard mast producing species in Ontario, since it produces seed at an earlier age and in greater quantities than white oak. However, white oak is a very long-lived species that produces a yearly mast crop with high nutritional value. Other important mast trees include, American beech, hickories, hazelnut, butternut, black walnut, other oak species, and to a lesser extent ironwood. Historically, the endangered American chestnut was a major contributor of mast in Carolinian forests. In order to maintain biodiversity and structural elements, you should keep a minimum of ten large hard mast trees from a variety of species per hectare in your forest. Bigger crown characteristics are more important to mast production than the diameter of the tree. Dominant mature trees with large, rounded, vigorous crowns tend to produce the most mast. Consideration should be given to introducing group selection into harvest plans in order to maintain and regenerate typically mid-tolerant mast producing species. Prior to harvesting, managers should identify high quality mast trees as crop trees, and use those crop trees to guide the location of group openings. Larger openings will support soft mast species like black cherry, as well as understorey shrubs like choke cherry, elderberry, blackberry, raspberry, or grape. These can be important food sources for birds during the later part of the breeding season when insect numbers tend to decline, or during migration.

14. Manage in landscape context

Any forest management, no matter how intense, creates habitats for some species of plants and animals. Habitat for early successional species, though not static in nature, can be quick and easy to provide in abundance. Habitat for late successional species, on the other hand, is more difficult to provide and can take many years to develop. Ensuring there is adequate habitat to support viable populations of all native species over time is our greatest challenge. Individual management decisions can have cumulative impacts on regional forest quality and function. Managers of both small and large forest properties should consider landscape factors because boundary markers do not limit ecosystem functions and processes.

Group selection can be a good management choice for a landowner with lots of oak and black cherry in the overstorey, and little regeneration. However, if every landowner in the region decided to manage their forest using group selection, lots of habitat would be created for gap-dependent species, like the Hooded Warbler, but more sensitive species, like Acadian Flycatcher may be lost from the landscape. Ideally, working together to maintain habitat patterns and successional stages

Logging gap — Photo: Teresa Piraino

that are similar to the historic variety of ecosystems in the natural landscape is a commendable goal.

It is important to be aware of the position of your woodlot in the surrounding landscape. Long-term cooperation and planning with neighbours can be highly effective in reducing fragmentation and edge effects and providing habitat for area-sensitive and forest interior bird species. By considering special features, physical and biological management constraints, and long- and short-term changes in ecosystem conditions on managed and unmanaged areas within and adjacent to the woodlot in question, all landowners and managers can contribute to maintaining biodiversity across southern Ontario's managed forests. By employing a variety of silviculture approaches at the landscape level, including setting aside conservation reserves, the landowner will ultimately ensure the availability of habitat for the full suite of species. There is not one right way to manage at the landscape level. We need to remain open to new tools and information in order to continue to incorporate our best science into our management planning.

15. Additional considerations

Additional management considerations could be given to increase bird productivity or the health of your woodlot. To discourage high densities of Brown-headed Cowbirds and nest predators you should consider restricting housing. Housing development within and adjacent to woodlots will discourage many Neotropical migrant songbirds from breeding in these forests. Where this occurs, reducing the amount of mowed grass close to the woodlot edges may be beneficial. Cowbirds prefer short grass for feeding, including lawns, mowed recreation areas, road and field shoulders. Landowners with cats should keep these animals indoors as they are efficient predators of adult and nestling songbirds. Furthermore, recreational activities within woodlots should be restricted to trail systems. Activities such as motorized trail bikes, all terrain vehicles, horses, and mountain bikes that heavily compact the soil should be isolated or excluded.. These activities can also disrupt the soil enough that exotic invaders can establish more easily.

If you are planning to do some planting or restoration work, it is important to put the right tree in the right place—Ontario's native trees and shrubs have adapted to specific climates and sites. Land managers should make an effort to plant native species at appropriate densities, and at the appropriate time and location in terms of succession.

ATV trail through forest — Photo: Lucas Foerster

Male Baltimore Oriole — Photo: Marie Read

"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."

Aldo Leopold

Great Crested Flycatcher — Photo: Daniel Cadieux

WHERE TO BEGIN

Whether managing a woodlot for wildlife or for high-value timber production, the importance of making appropriate management decisions cannot be understated. Knowing what you have, what you want to do, and having the right tools and information available to help you do it, will go a long way to ensuring that your woodlot is managed in the best possible way. The silviculture system you choose for managing your stand should recognize the true potential of your forest based on its current condition and the productivity of your site (see *Assessing the Health, Vigour, and Quality of Your Woodlot* on page 78). The choice of a silvicultural system, and the preparation and application of a silvicultural prescription usually requires the assistance of a professional forester. Consider the following before you harvest your woodlot:

1. **Goals:** Develop a management plan that outlines short- and long-term goals and objectives for your property. Work to conserve biodiversity by considering the range of species present and/or suitability of your woodlot for specialized species or specialized habitats when developing forest management plans (see *Habitat Management Considerations* on page 79). Ensure your harvest method will help achieve those goals. (If you are considering applying for the Ontario Managed Forest Tax Incentive Program, you must have a management plan.) The province has produced *A Guide to Stewardship Planning for Natural Areas* that creates a good framework for developing a plan.
2. **Ecological conditions:** Some tree species are very adaptable and can grow in a wide range of geographical locations, climate zones, and soil types. Other tree species thrive under very specific conditions. Know your woodlot to understand how the ecological conditions affect the growth of existing tree species and the species you plan to regenerate.
3. **Stand characteristics:** Review the stand characteristics from your woodlot inventory (size of the area, species type, tree density, species composition, age, and understorey vegetation) to help you to determine which silvicultural system or harvest method will work best for you and what attributes to protect or emphasize. Be aware of the current state of your stand; if you inherited a degraded or poorly managed woodlot, it may take some years of careful management to reestablish a healthy functioning woodlot that will produce high value forest products and ecological services (see *Rehabilitating Degraded Woodlands* on page 80).
4. **Species regeneration characteristics:** When reviewing your inventory data, evaluate whether regeneration or small seedlings exist and which species seem to be dominant. If these are shade-tolerant species like sugar maple, beech, and hemlock then the selection system will continue to support their development and growth. If you have other less shade-tolerant species in the regeneration layer or represented in the overstorey you may need to consider group selection or even-aged systems to promote the perpetuation of those species in your forest. To regenerate a mixedwood forest of oak and pine, choose the shelterwood system. Small patch clear cuts may work best for shade-intolerant species like aspen, balsam poplar, or tulip tree because they require full sunlight for regeneration. Land owners must ensure the chosen silvicultural system and approach to logging is permitted under their local tree conservation by-law.
5. **Age:** Determine if you have an even-aged or uneven-aged stand. Trees in even-aged stands are about the same age (plus or minus 10 years) and form a single canopy

Photo: Lucas Foerster

Photo: Ken Elliott

layer. Natural disturbances such as fire or storms that kill all older trees at once create even-aged stands. Clear cutting and plantations in open fields also create even-aged stands. Pure aspen or red pine plantations are the best examples of even-aged stands.

In uneven-aged stands, trees of various ages and sizes grow together. The structure of uneven-aged stands consists of at least three tree layers—overstorey layer, intermediate layer, and understorey layer (often from three or more age classes). An example of this is a sugar maple dominated stand with various combinations of sugar maple, beech, yellow birch, and hemlock represented in the overstorey and as seedlings, saplings, and larger intermediate trees.

6. **Wildlife:** Review the information you have collected on wildlife. It is important to maintain a healthy forest after harvesting that includes wildlife habitat. As managers often use *habitat diversity* as a substitute for *wildlife diversity*, they must ensure high stand structural-complexity and maintenance of critical features. By maintaining a diversity of structural elements, these forests will support a diverse array of plant and animal life across a diversity of habitat needs. Options for maintaining wildlife habitat include: leaving a number of cavity and snag trees; leaving decaying wood on the ground; retaining quality mast trees, and protecting riparian zones and wetlands.
7. **Economics:** After identifying the best silviculture system for your objectives and getting an estimate of your expected product volumes, evaluate your potential markets and expected prices (Consult *A Landowners Guide to Selling Standing Timber*: http://www.ontariowoodlot.com/). Based on these estimates and expected changes in the market you may choose to wait for improvement in the markets before harvesting. Once you decide that it is time to harvest, take your time, and select a reputable company. Get at least three quotes along with references, and visit other harvest operations performed by the companies you are interested in contracting. Damaged woodlots can take years to recover. (Consult *A Landowners Guide to Careful Logging* http://www.ontariowoodlot.com/)
8. **Time (season):** Harvesting at the wrong time of the year might create problems such as damage to roads, soil compaction, erosion, fire hazards, and disturbing wildlife during critical times in their life cycles. To avoid these

Assessing the Health, Vigour, and Quality of Your Woodlot

A healthy woodlot provides habitat for a wide range of forest species in perpetuity. The health, vigour, and quality of your woodlot will depend on a variety of features including soil type, topography, climate, history of the woodlot, the tree-species composition, age classes, density across different tree sizes, forest type, understorey vegetation, and growth rate of tree species. The current condition of the trees that make up your forest drives what you can accomplish with your woodlot. It can take time and energy to develop a healthy woodlot, particularly where the site conditions (soil, climate, topography) are poor at producing high quality, fast growing trees, or previous management practices have predominantly left trees of poor quality, low vigour, or poor genetics. An assessment of your woodlot by an expert on tree health (professional forester or certified tree marker) will determine the balance of healthy and poor quality trees, providing you with information on the potential of your stand to grow and produce high quality wood products, while still considering wildlife habitat. While assessing the trees and overall woodlot health, experts will look for evidence of internal rot or diseases (such a cracks, scars, wounds, or mushrooms on the stems of the trees), deformities (crooked, bent or broken trunks), evidence of invasive species, low diversity of wildlife, plant life, or habitat structures. Trees with no defects, tall straight trunks, smooth bark, and full crowns are a clear sign of good quality trees. Armed with the knowledge of the state of health of your forest you can set realistic goals. Current management activities may need to be focused on stand improvement before you are ready to move ahead with long-term habitat and wood production objectives. Keep in mind, however, that maintaining the full range of birds and other wildlife species requires a small supply of declining, dead, and downed trees to be retained.

Photo: Robert McCaw

hazards, harvest during winter on frozen ground, particularly on wet or low-lying sites, or during extended dry periods that (may) occur during late summer and early fall.

9. Roads, skid trails and landings: Efficient forest management, woodlot enjoyment, and the protection of soil, water, wildlife, and long term growth requires a logical system of roads, trails, and landings. Careful planning, construction, and maintenance puts them in the right place at the right time of the year and avoids wet and other sensitive sites. Since the compaction and disturbance associated with heavy equipment degrades these areas, the idea is to design a system that minimizes the area covered and is re-used over the long term.

10. Subtle changes for biodiversity: Consider the recommendations in this guide (see *Ten Easy Ways to be Careful Land Managers* page 83). Many of Ontario's landowners are leading the way in conserving high value natural areas. Some of the changes we are suggesting require only minor adjustments to what you may have practiced for years. Once the greater majority of woodlot managers invoke these changes, the forests of southern Ontario will be more diverse, more resilient, and more productive in the end.

Habitat Management Considerations

Individual landowners face a seemingly overwhelming task of managing the full range of biodiversity present on their property. A diverse forest requires a diversity of habitats because the habitat needs (food, water, shelter, and territory) of every species is slightly different from others. It is not possible to maintain all elements of biodiversity in all places, at all times, on any single piece of land. Forest managers need to consider the most effective way to provide biodiversity on a site-specific basis.

Timber management in the 1980s in Ontario focused on integrating the habitat needs of featured wildlife species such as hunted species or species at risk. In the 1990s, management philosophy shifted toward ecosystem management and the maintenance of biodiversity and habitat for all wildlife. Meeting the needs of all species requiring hardwood forests in southern Ontario are difficult given the large number of species and the variety of requirements. You can maintain the habitat needs of all wildlife at a large, landscape level by combining a *coarse filter* and *fine filter* approach to management. One of the key underlying assumptions about biodiversity management is that you are more likely to maintain native species and ecological processes if you manage your forest to resemble forests created by natural disturbances such as fire, wind, insects, and disease.

The coarse filter approach focuses on maintaining habitat diversity across the landscape through time. It provides a broad range of habitats for a broad range of species. Under this approach, we can maintain biodiversity in managed forests by maintaining habitat patterns and successional stages that are similar to those present naturally. The closer management resembles natural disturbances, the lower the risk of losing natural biodiversity. By providing a full range of structures, habitats, sizes, and ages representative of a particular ecosystem the needs of most organisms are fulfilled.

You can meet the habitat needs of most species if you are able to provide a full range of structure, habitat sizes, and ages at all times. However, managing for critical habitats for key species using the fine filter approach can be necessary for species whose habitat requirements are not fully met in the coarse filter approach. The fine filter approach focuses on single species management, by providing habitat for individual rare or specialized species of concern. At the stand scale, silviculture prescriptions can be modified to protect or enhance habitat suitability for individual species (i.e., maintain snags with cavities in forested swamps for Prothonotary Warbler or retain stick nests for raptors). However, developing a biodiversity strategy based on a variety of management strategies for individual species is neither feasible nor effective since the detailed habitat needs of many species are still unknown.

As a baseline, land managers should strive to maintain a diversity of habitats and habitat features as a stand-in for biological diversity. The *"if you build it they will come"* approach should work, as species tend to be associated with the structural attributes of a *seral* (successional) *stage*, rather than with the actual stand age itself. Species have requirements for survival that are tightly connected to their habitats, and degradation or loss of habitat is often the primary threat to species survival. Efforts should be made to leave important biological legacies of structures and features like standing dead and dying trees, downed wood, forest floor organic material, cavities, logs, snags, pools, and hedgerows. Given the high degree of ecological variability in our forests and the multiple resource objectives that managers juggle, they need to be flexible and creative. By considering both a coarse and fine filter approach to management, conservation of all species across southern Ontario is possible.

Eastern Screech Owl — Photo: Al Woodliffe

Photo: Lucas Foerster

Rehabilitating Degraded Woodlands

Many woodlot owners have purchased or inherited a woodlot that is degraded and has been mismanaged recently or repeatedly through diameter-limit harvests or high grading. In many cases the landowners are interested in cost efficient methods to repair damage, improve tree growth, quality and re-establish healthy ecological functions. While these are commendable goals, the pathway to recovery will differ depending on the quality of the site and state of degradation. These two factors will determine how long it will take and what effort is required to restore your forest.

As with any forest management project, you should consult experts at the planning and inventory stage. An assessment is required to determine the site quality and the level of soil damage the site has sustained. Harvests using diameter-limit cuts (with landowners uninterested in controlling logging practices), often lead to excessive skidding, soil compaction, and rutting, reducing future growth rates and the health of residual trees. Injuries to the remaining trees like bark scrapes, broken tops, and severed roots provide entry points for fungi inducing rot, hampering growth potential and future value. An initial inventory will evaluate the number and distribution of healthy trees that remain.

Land managers attempting to rehabilitate stands that have undergone repeated diameter-limit or other heavy cutting are likely to face numerous challenges:

- Mature or semi-mature trees are absent from many areas of the woodlot. This is known as *under stocked.*
- There are very few trees of good vigour and quality left—severely limiting volume and growth potential.
- The trees that remain are poorly distributed across the woodlot. They can be left in periodic clumps or completely isolated, limiting growth and control over the species that develops in the understorey.
- Very limited commercial value remains on the site. This makes operations in the next cutting cycle marginal or even at a cost.
- If there is limited existing tree regeneration, the low number of high quality seed trees left on site will compromise seed production and the establishment of new seedlings.
- As trees that remain are often poor quality or small, the genetics of new seedlings will be comprised of low quality, inferior parent trees.
- The establishment and growth of new tree seedlings will be challenged by the dense response of competing shrubs and other interfering plants (like raspberry) that will flourish in the very open canopy, where full sunlight exists.

Recovery from this list of problems may seem overwhelming and clearly indicates the importance of using good silviculture and avoiding diameter-limit cutting right from the start. However, land managers can work to bring a woodlot back to a more sustainable condition. Depending on the severity of degradation, this may take many years if not decades and will, in many cases, require financial investments.

Rehabilitation will be most effective when it targets the limitations in stand structure and focuses on improvements in the remaining elements with the best potential, including:

1. **Desirable trees**
   Identify all trees with no defects or damage and those with minimal damage without infectious diseases (conks, cankers) across all sizes of residual trees. Watch for representatives of all species that are suited to the site and wildlife trees (cavity trees, snags, mast trees, etc.) These desirable trees will be responsible for seed supply, wildlife habitat, and commercial potential for future harvests.
2. **Improve spacing and quality**
   Where necessary improve spacing for desirable residual trees by removing the poorest neighbouring trees through targeted thinning. This will improve seed production and growth on trees with the best genetics, health, and quality.
3. **Advanced regeneration**
   Identify and protect areas of established tree seedlings and saplings (*advanced regeneration*). These patches of seedlings should not be trampled or driven over by logging equipment or any other vehicles. It is these areas that will largely determine the future forest composition.
4. **Maintain growth of advanced regeneration**
   Overhead shade provided by single undesirable trees in or adjacent to patches of advanced regeneration should be carefully removed to allow for maximum growth of desirable seedlings. Regeneration patches should be monitored for competition from undesirable shrubs and trees. Where competition is severe, tending operations should remove the competitors as early and often as possibly (for up to 10 years) until desirable trees are clearly above the height of the competition.
5. **Establish trees in open spaces**
   Within a few years of the last harvest operation monitoring activities should identify patches where there is limited tree regeneration. Target these areas for regeneration by considering: site preparation, seeding, planting, monitoring, and tending. The goal is to establish regenerating trees of local seed sources across all areas of the stand where trees would normally occur as quickly and efficiently as possible.

In some cases, especially on poor sites or under severe cases of abuse, time and money can only do so much and you will need to be realistic in your expectations. Often high-grading or diameter-limit activities remove all the old age classes and push stands towards a more even-aged condition. In the most severe cases, all the mature and semi-mature trees have either been removed or damaged and have no

potential. In these cases, the manager is really striving to do the best thing possible with the next generation: targeting the advanced regeneration and new trees that become established. The overstorey is still needed to provide protection, proper light conditions, and wildlife habitat. Activities in the overstorey will primarily be directed to providing the best conditions for growing the new forest while maintaining structure and food resources for birds and other wildlife.

In summary, you should retain as many of the best trees as the situation will permit. Land managers should strive for uniform spacing between trees, and work toward establishing a new age-class of trees between and beneath residual trees. This takes a careful evaluation of the current conditions, and consideration of the costs and potential future benefits. Using these rehabilitation measures will improve health and vigour and decrease the time it takes for your woodlot to return to a sustainable state. Following good silviculture initially is really the best tool for maintaining continuous and consistent benefits including a steady supply of valuable wood products.

Benefits of Birds in Forests

Clearly, forests provide food and habitat for many bird species, but it may not be obvious that the presence of birds is essential to maintaining the health and productivity of the forest. This mutually beneficial relationship (*symbiosis*) is just one of several reasons forest managers must aim not only to grow healthy trees but also to meet other goals, including protecting and maintaining healthy forest bird populations. Birds provide a variety of services, particularly as predators, pollinators, and seed dispersers that are beneficial to forests. As predators, birds play an important role in insect control, reducing destructive insect numbers in forests by as much as 80–90 percent. Birds can help prevent outbreaks by congregating in areas of greater insect populations (i.e., woodpeckers are important predators of emerald ash borer). They are particularly effective at low to moderate insect densities. Almost all forest birds eat insects, primarily larvae of butterflies, moths, and beetles. As predators of leaf-chewing insects, birds can reduce defoliation rates, maintain a fuller leaf canopy, and thereby improve tree growth and health. Much of their prey includes insects that not controlled by natural means, particularly insects that are not vulnerable to parasites. Many wasps and some flies are parasites that live on or within their host insects, and ultimately kill them. These parasites are valuable as natural pest control agents. Birds spread insect parasites, further aiding in natural insect control. Woodpeckers help parasites by creating openings under bark through which the parasites can enter. Because most woodpeckers are non-migratory, they provide year-round insect control for particular areas. As natural insect control agents, forest management practices that benefit diverse insectivorous bird populations are important to the maintenance of forest productivity. Hummingbirds play colourful and functionally important roles as pollinations of wildflowers and tree flowers throughout the world. In eastern North America, there is only one species, the Ruby-throated Hummingbird.

Blue Jay with acorn — Photo: Marie Read

Hummingbirds have very good eyes and are extremely attracted to brightly coloured red, orange, or yellow (also visit white) flowers. They thrust their long slender bills deep into the tube shaped flowers, withdrawing faces dusted in pollen. To meet their high energy needs, hummingbirds visit numerous flowers regularly, which not only assists pollination, but increases gene flow among plants *(genetic diversity)*. Another big role for birds is seed dispersal. It is well known that seeds, in particular oak acorns are an important food source for many birds. In fact, trees like oak depend on seed or acorn consuming wildlife to disperse their seeds. Blue Jays play a critical role in oak dispersal and oak succession as they have a thick bill to pound and break acorns into smaller pieces and an elastic oesophagus that allows them to carry several acorns at a time. By carrying the acorns to new areas and burying them, Blue Jays can improve germination and the spread of oak at a local scale. They are particularly effective at dispersing acorns from oak forests to open or semi-open environments such as old fields and forest edges, which are favourable for acorn germination and seedling growth. Oak populations, like some bird populations, are declining in eastern North America. This is not only a concern for people who love trees, but for the variety of birds and other wildlife that rely on them. As the proportion of oak declines in forests, they are most often replaced by shade-tolerant maples. A regional change from oak to maple dominated forests, can strongly affect avian community structure and populations of some common bird species. Managers should strive to maintain oak as an important component of woodlands where it already exists, to avoid any cascading loss of biodiversity.

Blackburnian Warbler — Photo: Daniel Cadieux

> "There is a way that nature speaks, that land speaks. Most of the time we are simply not patient enough, quiet enough, to pay attention to the story."
>
> Linda Hogan

Male Blue-winged Warbler — Photo: Jeff Nadler

SUMMARY

Ten Easy Ways to be Careful Land Managers

1. Get professional forest management advice.
2. Use an appropriate, recognized silvicultural system (move beyond diameter-limits; consider group selection).
3. Use a written prescription for harvesting.
4. Retain large and extra large trees (some of which will be low quality/value).
5. Maintain or manage for high levels of structural diversity.
6. Consider leaving uncut areas.
7. Retain old growth and wildlife features:
    - live cavity trees (10/ha), mast trees (10/ha), snags (5-10/ha) (the bigger the better)
    - maintain or improve native tree species diversity
    - protect existing downed wood and add where possible
    - retain stick nests where they exist
    - preserve the integrity of wet areas (ephemeral ponds, seeps, streams, etc.)
    - retain and protect the habitat of species-at-risk
8. Demand careful, high quality logging without damage.
9. Calculate economic benefits over the long term.
10. Enjoy your woodlot!

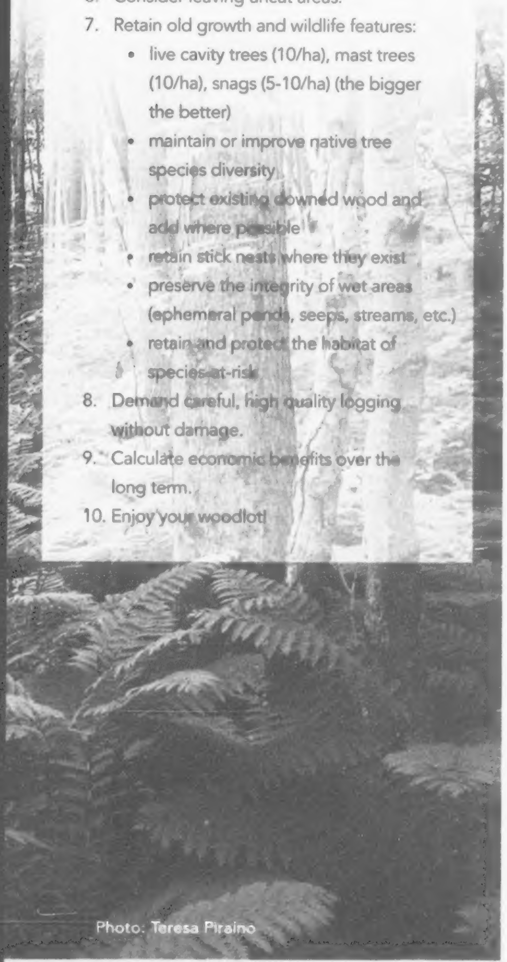


Photo: Teresa Piraino

Southern Ontario was once a forest dominated landscape. Today, that forest is broken into many different woodlots of varying sizes and shapes, often isolated from adjacent woodlots. These pieces are owned and maintained by a large number of private landowners and a few public landlords. This creates the backdrop for the fragmented forest ecosystem we see today. Despite these changes on the landscape, on any early morning in late May, in almost any woodlot (5 ha or greater), you only need to listen for a few minutes to become completely overwhelmed by a cacophony of songbirds belonging to 30 or more species. These birds, together with the trees, plants, butterflies, and other life you see, are all recent descendents of what once was nearly continuous forest. Since the time of European settlement (200 years) many of these forests have remained vibrant and productive. This resilience is amazing and reassuring.

Appreciating the resilience of these forest ecosystems and recognizing their limitations are likely the two most important philosophical points to consider when preparing to conduct management that will be compatible with the needs of the future forest landscape. Researchers have begun to untangle some of the mysteries associated with changes in forests caused by natural or human disturbances. By studying changes in the composition and density of regeneration on the forest floor, forest scientists can make predictions about what the future forest composition will resemble. By observing the composition of forest birds and calculating the success of their nesting attempts, biologists can determine whether the forest is self-sustaining for a given mix of species. Both types of indicators, tree seedling diversity and bird productivity, provide clues to the direction of future forests.

We know that birds and forests are so intimately linked that learning about both has helped to improve our understanding of how the entire forest ecosystem functions. It seems there is a bird for every part of the system, whether it's treetop nesters, ground dwellers, shrubby open canopy inhabitants, or cavity dependent species. There is a niche for each species, and a story about the forest that can be told by their population health and productivity. Land managers who strive to maintain and enhance the wide range of habitats available on their properties will help maintain biodiversity and the ecological resilience of the entire landscape.

Careful management based on sustainable methods has proven to be the most economical in the long run. Managing first to promote structural diversity will provide habitat for a large variety of species. By coupling this with fine scale management plans aimed at individual sensitive species where they exist, landowners will promote healthy forest ecosystems across the landscape. By getting to know your woodlot and its inhabitants, managers can make decisions that do not preclude harvesting for economic gain, but further improve or maintain conditions for birds and all biodiversity. These types of diverse forests are more resistant to insects and disease, and have a greater buffering capacity against other stresses such as climate change. Where possible, efforts should be made to improve forested habitat through reforestation, invasive species removal, and rehabilitation of degraded woodlands. Landowners, land managers, foresters, tree markers and loggers are key players in ensuring we have vibrant and healthy woodlands that can persist and sustain themselves into the future.

No parks system, conservation organization, tree planting program, or government agency alone or in combination will maintain the trees, plants, wildlife, insects, fungi and water quality of this diverse landscape. With 90 percent of southern Ontario woodlands in private ownership, it is your decisions as landowners, that will determine the future of our biodiversity and natural resources.

Cedar Waxwing — Photo: Jeff Nadler

"Nature is an infinite sphere of which the center is everywhere and the circumference nowhere."

Blaise Pascal

Trembling aspen — Photo: Robert McCaw

ADDITIONAL RESOURCES

- *A Silviculture Guide to Managing Forests of Southern Ontario*, OMNR. 2000. Available on OMNR website — mnr.gov.on.ca
- *Woodlot Management: Best Management Practices Agroforestry Series Volume 1*. 2007. Available from the Ministry of Agriculture Food & Rural Affairs website — www.omafra.gov.on.ca
- *A Guide to Stewardship Planning for Natural Areas*. Available on OMNR website — ontariostewardship.org
- *A Landowner's Guide to Selling Standing Timber.* Available on Ontario Woodlot Association website — ont-woodlot-assoc.org
- *A Landowner's Guide to Careful Logging*. Available on Ontario Woodlot Association website — ont-woodlot-assoc.org
- *Silence of the Songbirds* by Bridget Stutchbury

Useful Internet sites

- LandOwner Resource Centre: lrconline.com
- Ministry of Natural Resources, Ontario Forests: mnr.gov.on.ca (see Fact Sheets for Landowners: *Extension Notes*)
- Ontario Forestry Association: oforest.ca
- Ontario Federation of Naturalists: ontarionature.org
- Eastern Ontario Model Forest: eomf.on.ca
- Nature Canada: naturecanada.ca
- Carolinian Canada: carolinian.org
- Ontario Professional Foresters Association: opfa.ca
- U.S. Forest Service: www.fs.fed.us/ or www.na.fs.fed.us/
- MNR species at risk website: mnr.gov.on.ca

Wild Turkeys — Photo: Greg Lavaty

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Adult Wood Thrush by nest — Photo: Peter Burke

Bird Species of Concern

Bird Species of Concern

Species	**Occurrence**	**Breeding Habitat**	**COSEWIC/COSSARO Status**	**BCR13 PRIORITY Status**	**Breeding Bird Survey Trend**
Bald Eagle	B,M,W	Riparian	END		IN
Eastern Kingbird	B,M	Riparian	Low Priority/Candidate		DN, DO
Belted Kingfisher	B,M	Riparian	NAR		DN, DO
Golden-winged Warbler	B,M	Shrub/ES	THR/SC	Highest	Irregular trend
Hooded Warbler	B,M	Shrub/ES	THR		IN IO
Yellow Breasted Chat	B,M	Shrub/ES	SC		Irregular trend
Eastern Towhee	B,M	Shrub/ES	NAR		DN, DO
Blue-winged Warbler	B,M	Shrub/ES	NAR	High	Stable, SN, SO
Prairie Warbler	B,M	Shrub/ES	NAR	Medium	No data
Red-headed Woodpecker	B,M,W	Forest	THR/SC	Medium	DN, DO
Eastern Wood Pewee	B,M	Forest	High Priority Candidate		DN, DO
Acadian Flycatcher	B,M	Forest	END		No data
Wood Thrush	B,M	Forest	High Priority Candidate	High	DN, IO
Kirtland's Warbler	B,M	Forest	END		No data
Cerulean Warbler	B,M	Forest	SC	Highest	DN, DO
Prothonotary Warbler	B,M	Forest	END	Medium	No data
Louisiana Waterthrush	B,M	Forest	SC		No data
Canada Warbler	B,M	Forest	THR	Medium	DN, DO
Ruffed Grouse	R	Forest	NAR		DN, DO
Red-shouldered Hawk	B,M	Forest	NAR		DN, IO
Black-billed Cuckoo	B,M	Forest	NAR	High	DN, SO
Whip-poor-will	B,M	Forest	THR		DN, DO
Northern Flicker	B,M	Forest	NAR	Medium	DN, DO
Brown Thrasher	B,M	Forest	NAR	High	DN, DO
Ovenbird	B,M	Forest	NAR		DN, DO
Scarlet Tanager	B,M	Forest	NAR	Medium	DN, DO
Rose-breasted Grosbeak	B,M	Forest	NAR	Medium	DN, DO
Baltimore Oriole	B,M	Forest	NAR	Medium	DN, DO
Legend					SN — Stable nationally SO — Stable in Ontario
	B — Breeding	ES — Early Successional	SC — Special Concern	BCR — Bird Conservation Region	DN — Declining Nationally
	M — Migration		THR — Threatened		DO — Declining in Ontario
	W — Wintering		END — Endangered		IN — Increasing Nationally
	R — Resident		NAR — Not at Risk		IO — Increasing in Ontario

Glossary of Terms

abiotic — non-living environmental factors, such as light, wind, rock, soil, and water.

abundance — the number of individuals of a given species in a population.

active management — meeting desired forest objectives and future conditions using various management practices to affect growth, density, health, harvest, regeneration, etc. Active forest management may include planning, timber harvesting, tree planting, thinning, tending, weed control, road and trail maintenance, and other activities for improving wildlife habitat.

adjacent housing — any dwelling that is close to, or shares a common border with forest.

advanced regeneration — An established understorey consisting of seedlings and saplings.

aerial foragers — birds that feed by capturing prey in the air.

aerial insectivore — species that specialize on flying insects for food (such as flycatchers, swifts, and swallows).

age class — a category that describes trees, or stands of a similar age. The age class division separates trees of different species into classes based on a similar age, often 20-year intervals.

area sensitive — species that require large or continuous patches of natural habitat. Responses will vary depending on the level of sensitivity; some species will be absent from forest patches of a particular size, others will be less common, or show poor productivity in smaller forest fragments.

avian — relates to birds.

bark gleaners — species that pick insects from the surface and crevices of tree bark, twigs, and branches.

barrier — something that prevents or limits movement of an organism.

basal area — the cross-sectional area of a tree measured at 1.3 metres above the ground (breast height). Typically expressed in m^2/ha, based on the measure of all the trees in a stand.

baseline — an imaginary line or standard by which things are measured or compared.

best management — defined as the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on procedures that have proven themselves over time for large numbers of people. Forestry best management practices conserve soil, water, wildlife, and forest resources over the long term.

biodiversity or biological diversity — the number and variety of species of plant and animal life within a region. This includes differences within species (at the gene level), between species, and within and amongst ecosystems. A high level of diversity within a species, or genetic diversity, helps the species to survive massive changes in climate and the environment. Ecosystems with a high level of diversity support a greater number of life forms are more stable, and resilient to change.

biomass — the mass of organic matter in a given area. It also refers to plant matter burned as fuel.

biotic — Living components of the environment or ecosystem such as plants and animals.

blowdown — an area where trees have fallen due to wind.

blowsands — open areas of blowing sand that occurs when the vegetation is removed and the topsoil erodes. These areas have dry and infertile soil susceptible to wind erosion.

boreal forest — the largest, most northern forest region in Ontario, dominated by conifer species like spruce and jack pine. This forest region occurs in a wide band from Newfoundland to Alaska, from Hudson Bay, south to the north shores of Lake Superior. The boreal forest climate includes short warm summers and long cold winters.

breeding — the time when animals are producing offspring or young. For birds, this corresponds to the period when they are building nests and raising young.

breeding cycle — the timeframe of reproductive activity from initial courtship and pair formation through nesting to the final independence of the young. For birds, this typically begins with males finding a territory, followed by attracting a mate, copulation, nest building, nesting (including egg-laying, incubation, hatching, feeding of nestlings), to parental care of young that have left the nest until they are able to care for themselves.

breeding ground — the place where animals breed.

breeding population — a group of organisms whose choose mates from within the group. Often the breeding population is within an individual woodlot.

breeding range — the geographical area where breeding activities occur. For non-migratory birds or permanent residents, their summer breeding range will overlap their winter range. For migratory birds, their winter range is hundreds or thousands of kilometres away.

breeding season — the period of time in which species breed, usually when favourable conditions, abundant food, and water are present. Different species of animal and birds have different breeding seasons according to their particular requirements and food availability. For most bird species in southern Ontario, this occurs between April and August.

breeding site — the microhabitat in which breeding occurs. For example, vernal pools are breeding sites for frogs.

broadleaf — a class of trees that have broad, flat leaves of many different shapes; most are deciduous; also called hardwood, because most broad-leaved trees have harder wood than do conifers. Examples include oak, hickory, maple, and ash.

brood — a group of young produced or hatched at one time from a single set of parents. Some birds mate and have more than one group of young in a season.

Glossary of Terms

brood parasite — a bird that lays their eggs in other birds' nests, often removing some of the host's eggs in the process. The most common brood parasite in southern Ontario is the Brown-headed Cowbird.

browse line — the height below which woody foliage and small twigs have been more or less completely consumed by moose or deer. In areas of high deer density, the forest appears very open below this line as saplings and shrubs are absent.

buffer — a designated zone or strip of land of a specified width along the border of a natural feature or natural area. Land managers can leave buffer strips of standing trees by water sources to protect water quality. Managers could also use buffers with limited or no harvesting to protect special features such as streams or stick nests.

Canadian Shield — a huge geological rock formation that covers much of Canada, extending from the Great Lakes north to the Arctic Ocean. The surface of the Shield has very thin soil lying on top of the bedrock, with many bare outcrops. A typical Canadian Shield natural area consists of pines, lakes, bogs, and rock. Vast expanses of the Canadian Shield are boreal forest.

canker — a dead area of a branch or stem caused by fungus or bacteria that damages the bark. Some cankers are of minor consequence, but others will kill the tree. Cankers typically appear as sunken patches where the bark is missing, and surrounding these lesions are patches of growth that are callused and bumpy.

canopy — the forest cover of branches and foliage formed by tree crowns of older trees. The canopy or overstorey forms the uppermost level of the forest.

canopy gap — a hole or break in the forest canopy that allows sunlight to reach the forest floor. Tree falls, wind, disease, insects, or logging operations cause canopy gaps. These gaps provide open, sunlit conditions that many tree species need to germinate and grow.

canopy tree — a tree that forms part of the canopy.

carbon sequestration — the removal of carbon dioxide from the atmosphere into storage, typically in plants, soil, and the ocean. Prevents the release of carbon to the atmosphere in order to mitigate climate change.

carbon sink — forests and other ecosystems that absorb carbon, and remove it from the atmosphere.

Carolinian forest — is a life zone in eastern North America characterized primarily by a predominance of deciduous, or broad-leaf trees. It spans from the Carolinas in the United States to the northern tip in southwestern Ontario. This region provides Canada with its most distinctive and richest abundance of plant and animal life. Trees such as various species of ash, birch, chestnut, hickory, oak, and walnut grow in the Carolinian forest. The climate is mild in winters and hot in summer.

catkin — a cluster of tiny flowers, usually fuzzy and caterpillar shaped produced for reproduction by tree species such as birches and willows. These unisexual flowers are typically found on wind-pollinated trees.

cavity nest — a nest built within a natural or excavated hole located in the heartwood of a tree. A variety of birds and animals use cavity nests: such as woodpeckers, chickadees, and flying squirrels.

cavity tree — a standing tree, dead or alive, that contains one or more holes that could be used by birds and animals for nesting, denning, roosting, resting, feeding, escape, or hibernating.

chestnut blight — a fungal disease that attacks and kills American chestnut trees, and has virtually eliminated this once widespread tree.

chicots — a dead limb or tree that is a danger to workers.

circumference-limit — see diameter limit.

clear cut — an area in which all of the trees are removed in one cut. This regenerates into an even-aged forest.

climate — is the average weather of a region over a long period of time. This includes the temperatures, humidity, rainfall, frequency, and intensity of storms, heat waves, and other weather events.

climate change — significant and long-term global change in average weather patterns over time, where the build-up of manmade gases in the atmosphere trap the suns heat, causing changes in weather patterns on a global scale.

clutch — the nest of eggs, or the number of eggs produced or incubated by a bird at one time.

coarse filter approach — an approach to maintaining biodiversity that involves maintaining a diversity of structures within stands and a diversity of ecosystems across the landscape. The intent is to meet most of the habitat requirements of most native species.

coarse woody debris — sound and rotting logs and stumps that provide habitat for plants, animals, insects, and nutrients for soil development.

community — a group of plants and animals living together in the same region and interacting with each other.

competition — a rivalry between individuals or species, for a limited supply of food, water, mates, habitat, light, growing space, etc., that both individuals or species require.

composition — refers to the number of patch types and their relative abundance in a stand or on a landscape. Can refer to the number of individuals of each species in a community (community composition), or the mixture of forest types in a landscape, with respect to landscape composition.

configuration — the arrangement and shape of habitat elements (e.g., edge, forest) relative to one another.

coniferous — a type of tree that bears cones and evergreen leaves or needles. Often called softwoods, this group includes pines, spruces, firs, and cedars.

continguous — touching or connected. Contiguous habitat refers to large expanses of forest unbroken by roads or other forms of human development.

conk — hard bracket or shelf fungi found on declining or dead trees. These resemble mushrooms and invade through tree wounds, causing the wood to rot. Conks vary in size, colour, and tree location.

connectivity — the degree to which habitat patches are linked across the landscape. A landscape feature that facilitates the movement of biota between blocks of habitat, such as hedgerows or riparian areas, will increase connectivity.

conservation — preservation and careful management of the environment and of natural resources to prevent exploitation, destruction, and loss of that feature over time.

coppice growth — a method of regeneration in which a tree or shrub sprouts many small shoots from a cut stump.

corridor — linear and narrow stretches of land that connect distinct patches on the landscape. Corridors provide connectivity and permit the movement of plant and animal species between what would otherwise be isolated patches.

critical habitat — the specific areas or habitat features essential to the survival of a species. Often refers to the conservation of particular natural areas or habitat features for species at risk.

cup nest — a type of bird nest that is built or woven in a cup shape from plant materials (grasses, roots, stalks, and/or sticks), hair, mud, and feathers. Most songbirds, such as robins and grosbeaks, construct this type of nest on the ground or in trees, shrubs, or herbaceous plants.

cutting cycle — under the selection system this is the planned interval between major partial harvests in a stand, often 15–20 years in southern Ontario forests.

deciduous — trees and shrubs that loose their leaves each fall.

declining tree — a tree that exhibits signs of poor health, such as a reduced canopy, dead limbs, or evidence of disease.

degraded woodland — any forest with reduced ecological function, productivity, or diversity. Often refers to woodlands subjected to a history of poor management (over-harvesting, high grading, diameter-limit, high intensity, or high frequency harvests) such that large, healthy, fast growing trees are typically absent.

desiccation — process of being thoroughly dried out.

diameter at breast height (dbh) — a measure of the diameter of a tree at 1.3 metres above the ground.

diameter class (size class) — one of the intervals into which the range of diameters of trees in a forest is divided for purposes of classification. These are often done in 2 cm increments.

diameter-limit — a method of forest harvesting in which all trees larger than a specified diameter are removed. This is not a recognized silviculture system in Ontario.

disperser — an organism that moves from its birth place to another location. For example, a salamander is a poor disperser and tends to move within 70 metres from its birth pond. A seed disperser refers to an organism or an environmental factor, such as wind or water that carries a seed from one area and deposits it in another.

double brooding — the production of two groups of young (i.e., broods) in one breeding season, by the same pair of adults. Typically, birds build another nest for the second brood, and the male cares for the first brood while the female tends her new nest.

downed woody debris (DWD) — any dead woody material, such as branches, logs, and tree tops on the ground. Nutrient cycling, water retention, soil disturbance, soil formation, erosion control, seedbeds, and wildlife habitat are some of the ecological functions that relate to down woody debris.

Dutch elm disease — a fungal disease of elm trees which is spread by the exotic Asian elm bark beetle. It has devastated native populations of elms that have not evolved resistance to the disease.

early successional forest — an early successional forest is the forest that becomes established immediately following a disturbance or the abandonment of land from other uses such as farming. It is often characterized by widely distributed, fast growing, shade intolerant shrub and tree species.

ecological function — the individual or collective role each species performs in an ecosystem which alters the surrounding biotic and abiotic environment. This is influenced by species abundance, fitness, and viability. For example, high abundances of white-tailed deer, who function as herbivores, can alter plant communities by excessive browsing, which disturbs the plant breeding function and can result in the loss of certain plant species or trees and their specific roles (functions), i.e., erosion control or nesting habitat.

ecological integrity — the ability of an ecosystem to function and continue to provide natural goods and services while maintaining biodiversity.

ecological trap — an area of falsely attractive habitat preferentially selected by a species, resulting in poor survival and reproductive success. This typically occurs when the environment changes rapidly so that cues used for habitat selection are no longer reliably associated with high quality habitat.

ecologist — a person who studies ecology. See ecology.

ecology — the study of the distribution and abundance of life and the interactions between organisms and their natural environment.

ecosystem — the natural complex of all living components, such as plants and animals, functioning together in the abiotic environment in which they live.

edge — the boundary between dissimilar environments or habitats. In fragmented landscapes, edges are typically between forests and agricultural or developed land.

edge effects — a change in species composition, physical conditions, or other ecological factors at the boundary between two ecosystems.

edge specialist — any species associated with, or a specialist of, edge habitats.

Glossary of Terms

endangered — any native species, with a small or dwindling population at imminent risk of extinction throughout all or a portion of its range.

environment — the totality of surrounding conditions. All the living and non-living things surrounding and affecting an organism, or group of organisms.

ephemeral — existing for a short period of time.

even-aged management — the removal of all mature trees in a single cut (i.e., clear cut) or with multiple partial cuts (i.e., shelterwood) used to create a stand of mature trees of essentially all the same age.

evolutionary history — the changes in genetic makeup or inherited traits that a particular species or population of organisms has undergone over hundreds (or more) generations.

exotic — an organism that is not native to a particular area, introduced as a direct or indirect result of human activity.

fauna — all the animal life of a particular region.

fine filter approach — an approach to maintaining biodiversity that is directed toward particular habitats, or single rare or specialized species of concern that might fall through the coarse filter. These habitats may be critical in some way and the species threatened or endangered.

fledge — the stage in a young bird's life when the feathers and wing muscles are sufficiently developed for flight. The term used to describe the behaviour by which a nestling bird leaves the nest under its own power.

fledgling — a young bird that has successfully left (or fledged) from the nest.

flora — all the plant life of a particular region.

foliage gleaners — species that feed by picking insect prey, such as caterpillars and aphids, off the surfaces of leaves.

food chain — a series of plants and animals linked by their feeding relationships. Food chains are often expressed as hierarchies where, each organism at one level uses the next, lower members in the sequence as a food source. One example of a simple food chain relationship would be a sugar maple sapling eaten by a white-tailed deer, and then a wolf eats the deer.

foraging guild — a group of birds (see guild) that forage in similar habitat or a similar manner (e.g., canopy foragers, or bark gleaners).

forest interior — the portion of the forest deep in the woodlot, uninfluenced by edge effects. This is typically expressed as forest habitat more than 100 m from any hard edge.

forest interior specialist — any species associated with, or a specialist of, habitat away from any forest edge.

forest management — a range of human activities that affect forest ecosystems. This includes harvesting, replanting, fire prevention, road building, etc.

forest type — group of forested areas or stands of similar composition (species, age, height, and stocking) which differentiates it from other such groups. The dominant forest type in southern Ontario is sugar maple-beech.

forester — a person engaged in the profession of forestry. Foresters engage in timber harvesting, ecological restoration, and management of protected areas. They manage forests to provide a variety of benefits for humans including direct extraction of raw material, recreation, conservation, hunting, aesthetics, as well as the less tangible benefits such as clean air or improved water.

forestry — the art, science, and practice of managing and using for human benefit the natural resources that occur on forested lands.

fragmentation — the process where large continuous habitat patches are broken up into smaller remnants of various sizes and shapes. Forests fragmentation results from the loss and subdivision of forest habitat by agriculture, roads, utility corridors, and urban areas.

gap dependent — any species that relies on canopy openings or gaps, such as those created during group selection harvesting, for all or part of its life cycle (typically breeding).

generalist — see habitat generalist.

germination — the process whereby seeds or spores sprout and begin to grow.

girdling — the deliberate or accidental process of removing a strip of bark around the circumference of a tree, causing its death.

good forestry practices — the proper implementation of harvest, renewal, and maintenance activities known to be appropriate for the forest and environmental conditions under which they are being applied. These practices minimize any detriments to forest values, including significant ecosystems, important fish and wildlife habitat, soil and water quality and quantity, forest productivity and health, aesthetics, and recreational opportunities of the landscape (*Forestry Act* 1990).

Great Lakes-St. Lawrence forest — a zone of transition forest between the conifer-dominated habitat of the boreal forest and the deciduous Carolinian forest to the south. Great Lakes-St. Lawrence region is centered on the Great Lakes, and distinguished by the presence of eastern white and red pine, eastern hemlock, and yellow birch.

greenhouse effect — the process by which human activities have elevated levels of carbon dioxide (CO_2) in the atmosphere, causing the temperatures near the surface of the earth to rise.

greenhouse gases — gases in the atmosphere that trap the sun's energy and thereby contribute to rising surface temperatures. The main greenhouse gas that contributes to climate change is carbon dioxide, a by-product of burning fossil fuels. Other greenhouse gases include methane (from agricultural sources) and nitrous oxide (from industrial sources).

ground cover — the layer of vegetation closest to the ground, typically less than half a metre in height. This includes herbaceous plants, mosses, and fungi that carpet the forest floor.

group selection — a method of uneven-aged forest harvesting in which small patches, or groups, of trees are removed. This creates a patchwork of openings within the forest, where young trees can grow. It favours mid-tolerant species that need some direct sunlight to thrive, and can be used in conjunction with single tree selection between the gaps.

growing stock — the volume (expressed in metres cubed [m^3]) of all live trees in a given area.

guidelines — an established practice or behaviour that should be implemented. Although guidelines are generally voluntary, the implication is that practitioners will use these concepts and principles in meeting their resource objectives.

guild — a group of species that use similar resources in the same way but are not necessarily closely related. Typically, birds form guilds based on foraging, nesting, diet, or habitat preferences.

habitat — the place where an organism lives and/or the conditions of that environment including the soil, vegetation, water, and food.

habitat generalist/generalist — a species that is able to thrive in a wide variety of environmental conditions and can make use of a variety of different resources.

habitat specialist/specialist — any species that can only thrive in a narrow range of environmental or habitat conditions or has a limited diet. Specialists are sensitive to environmental changes that influence that resource or habitat type.

hard edge — a distinct boundary between two very dissimilar habitat types. A woodlot bordered by an agriculture field or road are examples of typical hard edges.

hard mast — nuts produced by tree species such as oak and beech that are consumed by wildlife.

hardwoods — broad-leaved deciduous trees that generally (but not always) have a relatively high density and hardness. Ash, hickory, and oak are some of the most prominent hardwoods. Some hardwoods have softer wood than softwood (conifer) species.

harvesting — the practice of cutting and removing trees from a forest.

healthy forest — a forest whose structure, composition, and function allows for the maintenance of biodiversity and ecological processes over time.

heartwood — the central core of a tree, which is made up of dense, dead wood and provides strength to the tree. It usually differs from the outer wood layer (sapwood) by its darker colour.

heavy cut (heavy partial harvest) — any type of harvesting, such as diameter-limit or high grading, that results in a residual basal area of less than19 m^2/ha, and/or removes more than one-third of the basal area in a single harvest.

hectare — a unit of area 100 metres by 100 metres in size, or 10 000 m^2.

herbaceous plant — any plant with non-woody stems and leaves that die at the end of the growing season to the soil level. An herbaceous plant may be annual, biennial, or perennial.

herbicide — a chemical used to kill or control vegetation such as brush, weeds, and competing or undesirable trees.

high grading — a form of partial harvesting that selects only the best trees from a stand (the straightest, highest quality, and most merchantable trees). Over time, this leads to a residual forest of deformed and poor quality trees of low economic value.

host — an animal or plant that nourishes and supports a parasite. Host species do not benefit and are often harmed by the association. Birds, such as the Wood Thrush, that unsuspectingly raise Brown-headed Cowbird young, are typical Brown-headed Cowbird hosts, that suffer reduced productivity or nest success.

hydrology — the science dealing with the properties, distribution, use, and conservation of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

intermediate storey — the forest layer just below the canopy, also referred to as mid-canopy and consists of tree saplings, small trees, and tall shrubs. Trees in this layer usually range in size from 10–20 cm in dbh, 5–15 metres in height, and 10–60 years in age. Growth of saplings in this layer will often slow until a canopy opening occurs, releasing trees to grow rapidly upward.

invasive — a plant or animal, typically not native to an area, that tends to spread and then dominate the new area.

inventory — a survey of a forest area to determine such data as tree age, density, condition, species composition, etc. for specific purposes such as planning, management, or harvesting.

isolation — a measure of the distance between patches of similar habitat, often used to describe how close a woodlot is to the nearest woodlot of a particular size.

juvenile — a young bird that has left the nest but has not reached its adult form, sexual maturity, or size. Songbirds are juveniles for the first year of life.

landbird — the species of birds that occupy terrestrial habitats for most of their life cycle. Some landbirds are year round residents, some are short distance migrants, and others are long distance migrants.

landings — an open, flat area where logs are collected for loading onto trucks to be transported to a mill.

landscape — the visible features of a specific geographic area, including physical elements such as landforms, living elements of flora and fauna, and human elements, for instance human activity or the built environment.

Glossary of Terms

late successional forest — a stage in succession, which includes mature or old growth age classes. High densities of living and dead large diameter trees and high volumes of downed wood characterize this stage.

late successional species — organisms associated with mature and old growth forests.

leaf litter — dead plant materials, such as leaves, bark, and twigs, that have fallen to the ground, primarily from deciduous trees.

legacy tree — trees that are of great size, age, historical significance or rarity. These typically old trees have survived stand-replacing natural disturbances and harvests.

management — any human activity that directs specific plans to a given area of land.

management goal — a specific, defined objective to be achieved related to ecosystems, ecosystem components, or natural resources, to be affected by an action or development. Management goals may include the sustainable production of timber, the creation of habitat for wildlife, and/or stand health improvement.

management plan — written plan for current and future sustainable management practices to meet an owner's objectives. Managers renew these plans on a regular basis and require the approval of a professional forester. They are required for the Managed Forest Tax Incentive Program, and on crown land they describe management objectives and strategies for all forest resources within a particular licensed area.

mast — fruit, seeds, and nuts produced by trees and shrubs that are consumed by wildlife. Soft mast includes most fleshy fruits such as raspberry, dogwood seed, or black gum seed. Hard mast refers to nuts such as acorns, beech, and hickory nuts.

mast tree — any tree that produces mast (like oak, beech, cherry).

matrix — the background ecological system present within a landscape. In southern Ontario, most woodlots are surrounded by an agricultural matrix.

mature — trees or stands that have developed to harvestable age and are at or near rotation age, having attained their full growth potential, particularly in height and seed potential. Often refers to a stage in forest development in which the original dominant trees in the forest canopy begin to die and fall, creating canopy gaps that allow understorey trees to grow, and providing coarse woody debris on the forest floor. Sometimes used more broadly to include old-growth forest.

mature forest specialist — any species that specializes, or is associated with, mature forest.

microclimate — the climate of a specific area in the landscape which has substantially differing sun exposure, temperature or wind than surrounding areas, or the area as a whole. For example, the microclimate of the gaps created following group selection harvesting, are a hotter and drier microclimate than that of the surrounding forest.

microhabitat — a small habitat with different environmental or habitat conditions, within a larger habitat patch. A particular species may require unique microhabitat for foraging or nesting or seed germination (in the case of trees) that differs from the general habitat within its territory.

mid-canopy — see intermediate storey.

mid-tolerant — species that are moderately tolerant of shaded conditions, but require partial light in order to regenerate and grow. Mid-tolerant tree species include yellow birch and red oak.

migrant — any organism that undergoes regular seasonal journeys in response to changes in food availability, habitat, or weather.

migration — a regular, seasonal journey undertaken by a species. Many species of bird make annual migrations of hundreds or thousands of kilometres between breeding and wintering areas.

mineral soil — the soil, or layer of soil, dominated by mineral (not organic) matter. Mineral soil lies below the organic layer, is comprised of silt, sand, and clay with less than 20 percent organic material.

mixedwood — forest consisting of both deciduous and coniferous trees.

molt — the gradual shedding and replacement of all (complete) or some (incomplete) old feathers.

monoculture — a crop of plants of a single species (e.g., a red pine plantation).

native species — any species of plant, animal, or insect that occurs naturally in a particular region or habitat.

natural succession — the process of change that occurs naturally in composition and structure of a forest over time, as one biological community replaces another in a relatively predictable sequence.

Neotropical migrant — any species of bird that spends the winter months in Central America, South America, or the Caribbean islands and summers (breeds) in North America.

nest parasitism — when a nest or brood parasite lays its eggs in the nest of a host, or other bird species, requiring the host to raise and care for its young, (i.e., Brown-headed Cowbird).

nestling — a young bird that still resides in the nest.

no-cut buffer — an area or strip within which no harvesting occurs. These buffers are of variable width depending on the features they are designed to protect. See buffer.

no-cut reserve — a protected area where no timber is harvested.

nurse crop — any tree, shrub, or plant species used to protect, or enhance the growth of a more sensitive species by providing shelter, shade, and moist environments. Pine plantations may act as a nurse crop for hardwood species such as red maple.

offspring — a new organism produced by one or more parents.

old growth forest — a type of forest that has no evidence of human disturbances and has reached a great age and so exhibits unique biological features. Old-growth forest typically contains large and old live trees, large dead trees, and large downed logs.

organic layer — the top layer of soil, also known as humus, that is located just below the leaf litter and just above the mineral soil. It consists of decaying organic material (dead plants and animals).

organism — any living plant or animal.

output — any result, product, or service that is produced.

overstorey — the uppermost layer of the forest, formed by tree crowns, also called the main canopy.

partial harvesting — any harvesting method that retains a portion of the mature trees on the site. Group selection, diameter-limit, single tree selection, and the shelterwood system are classified as partial harvesting systems.

passerine — a group of birds known as perching birds. More than half of all bird species belong to this group, and many are songbirds.

permanent resident — any organism that does not migrate, thereby remaining in the same region year round. The Pileated Woodpecker is a permanent resident of southern Ontario forests, spending both the winter and summer in the same area.

pest — any unwanted insect, plant, or animal capable of causing injury or damage and is detrimental to human resources (trees, crops, livestock, etc.).

pit and mound topography — rolling terrain produced when old trees fall down. Pits or depressions are created when the roots and clinging soil are pulled up from the ground, exposing the mineral soil, mounds are created when root mat decays.

plantation — a stand composed primarily of trees established by planting or artificial seeding, typically in even spaced rows.

point count — a method of counting birds (census) in which the observer identifies all birds heard and seen during a certain period of time (usually 10 minutes) at a given point or location.

pollinators — any animal or insect that provides an important service for plants by moving pollen from a male flower to a female flower to enable seed plants to reproduce. Wind pollinates some plants.

population — a group of organisms of a particular species whose members breed mostly or solely among themselves, usually as a result of physical isolation, although biologically they could breed with any members of the species.

population sustainability — the continued existence of a given population over time without interruption, weakening, or loss of valued qualities.

population trends — quantifies changes in the number of individuals in a population of a particular region or across the species entire range over a designated time interval. Values indicate increasing, decreasing, stable, or unknown.

post-breeding period — the period of time after the breeding season, and prior to migration (if applicable).

predator — an organism that hunts and kills another for food.

preparatory cut — an initial, optional cut to enhance conditions for seed production, used in the shelterwood system. Removal of undesirable trees creates space for future seed trees to expand their crowns and improve conditions for seed production and natural regeneration.

prescribed burn — the deliberate and controlled burning of an area, such as a forest or prairie, to stimulate the regeneration of fire-dependent plants, reduce hazardous fuel levels that could result in intense and uncontrolled fires, control unwanted vegetation, favour desired vegetation, and improve wildlife habitat.

prescription — a site specific course of management action written up for a particular area after specific assessments and evaluations have been made. A prescription describes the objectives, measures, conditions to be met, and other specific operational strategies to be implemented when harvesting that stand.

primary cavity nester — a bird capable of excavating their own cavities, or hole for nesting purposes. Woodpeckers, such as the Yellow-bellied Sapsucker, are primary cavity nesters.

productivity — a measure of the capacity of a biological system. Forest productivity refers to a forest ecosystem's natural capacity to capture energy, sustain life, and produce forest resources. You can measure productivity for specific components: leaves, wood, above ground, or below ground components. Bird productivity refers to the number of offspring produced.

range — the geographical area or extent, where a species occupies an area. Changes to habitat or environmental conditions can result in the range of a given species increasing in area (range expansion) or shrinking (range contraction).

recruitment — in silviculture, recruitment is the process of maintaining, restoring, or increasing the seedling and sapling components of a stand. Wildlife recruitment is the addition of individuals to a population from all causes (i.e., reproduction and immigration).

reforestation — the natural or artificial establishment of forest cover after the trees are cut.

regeneration — the renewal of tree cover by establishing young trees naturally or artificially. Regeneration usually maintains the same forest type and is done promptly after the previous stand or forest is removed. Also refers to the young crop of seedlings.

Glossary of Terms

regeneration cut or seed cut — under the shelterwood system, where mature trees are harvested to create openings and provided conditions for securing regeneration from the seed of trees retained for that purpose.

rehabilitation — to restore a habitat to its original condition or former capacity. Rehabilitation includes a wide variety of activities such as tree planting, stream bank stabilization, removal of exotic species, garbage clean up, etc.

removal cut — the last one or two cuts used in the shelterwood system to release the established seedlings and saplings, which often occurs approximately 3–15 years after the regeneration cut (in hardwoods). Managers harvest most of the remaining mature trees to give the regeneration full sunlight and to encourage rapid growth.

reproductive success — measure of the number of young surviving. For birds, this refers to survival up until the time the young fledge from the nest.

resident — any organism that does not undergo seasonal migration.

restoration — the renewal of degraded, damaged, or destroyed ecosystems through active human intervention.

retention — to keep individual trees or groups of trees in harvested stands for varying lengths of time to provide a particular value, such as the retention of cavity trees during harvesting operations.

riparian — the interface between land and water. Related to, living in, or located in conjunction with a wetland, on the bank of a river or stream but also at the edge of a lake or tidewater.

riparian area — also referred to as riparian zone, which is an area of land adjacent to a stream, river, lake, or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.

rotation — rotation age or length is the number of years required to establish and grow a stand of trees to maturity and when it would be considered ready for the next regeneration harvest.

sapling — a young tree larger than a seedling but smaller than a pole. Saplings are typically 1–2 metres tall and range from 1–9.9 cm in dbh.

sapwood — the living wood in a tree that surrounds the heartwood. It conducts water and minerals from the roots to the leaves.

scale — a spatial perspective.

second growth forest — a forest or stand that has grown up naturally after harvesting (especially clear cutting).

secondary cavity nester — any animal that uses cavities for nesting but are incapable of successfully excavating their own nest. Secondary cavity nesters use natural cavities or cavities previously excavated by woodpeckers as nesting sites. Examples include southern flying squirrel and House Wren.

sedentary — non-migratory animals that typically inhabit a small home range.

seed bank (soil) — the reservoir of viable seeds present in the soil.

seedling — a young tree smaller than a sapling, with a diameter less than 1 cm and height <1 m tall.

selection (silvicultural) system — a silvicultural system that removes mature timber either as single scattered individuals (single tree selection) or in small groups (group selection) at relatively short intervals (8–25 yrs), repeated indefinitely, where the continual establishment of regeneration is encouraged and an uneven-aged stand is maintained.

sentinel tree — a super-canopy tree that is used by wildlife, especially hawks, to watch over and guard their territory.

seral stage — the series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage. It is a term used for each successional stage.

shade intolerant — species of plants that are sun loving, requiring direct sunlight to grow and reproduce. These species are incapable of growing or competing under canopy conditions. Shade intolerant tree species include aspens, white birch, and red pine.

shade tolerance — the capacity of a tree or plant species to develop and grow in the shade of, and in competition with, other trees or plants.

shade tolerant — species of plants that are capable of becoming established, compete for survival, and persist under the shade of a canopy. Shade tolerant tree species include maples and beeches.

shelterwood — a method of even-aged forest harvesting in which the forest is harvested in multiple partial cuts. This system will achieve a new even-aged stand under the shelter of remaining trees.

shrub layer — the lowest layer of woody vegetation in a forest, above the groundcover and below the understorey layers. As the name implies, this layer consists primarily of shrubs and saplings and occupies the vertical space roughly between 0.5–3.5 metres.

silviculture — the art and science of controlling the establishment, growth, composition, and quality of forest vegetation to meet the diverse needs and values of landowners and society on a sustainable basis.

silviculture system — a planned series of treatments throughout the life of the stand. A silviculture system includes harvesting, regeneration, and stand-tending methods or phases to achieve stand structural objectives based on forest management goals. It covers all activities for the entire length of a rotation.

single tree selection — a sustainable method of uneven-aged forest harvesting in which mature and/or undesirable trees are removed individually. This system encourages shade tolerant species regeneration. Typically, trees are removed from all age classes, targeting older and diseased trees while allowing younger healthy trees to grow.

site preparation — chemical (e.g., herbicides) or mechanical (e.g., cutting) processes used to remove unwanted vegetation and other material to prepare the soil surface as a favourable seedbed for either naturally or artificially dispersed seed or for planted seedlings.

site quality — the productive capacity of a site as determined by the amount of available light, heat, water, and nutrients.

size class — see diameter class.

skidder — a large wheeled or tracked vehicle used for dragging trees or logs from where they are cut to a log landing.

slash — the residue, such as treetops and branches, left on the ground after logging.

small scale disturbance — events that cause temporary change in average environmental conditions, and invoke a pronounced change in an ecosystem over a small area. Small-scale disturbances caused by wind, ice, disease, and harvesting result in a patchy distribution of disturbed (or gap) areas.

snag — a standing dead tree, or standing portion of a broken off tree.

soft edge — a boundary between habitat types that is less distinct in terms of habitat structure, such as the boundary between coniferous and deciduous forest types.

soft mast — fleshy fruits and catkins produced by plant species such as birch and raspberry that are consumed by wildlife.

softwood — wood produced from coniferous trees, which generally (but not always) have lower density and hardness than broad-leaved trees or hardwoods.

soil compaction — the compression of soil caused by heavy machinery during harvesting operations which causes the soil to lose pore space. Compacted soils become less able to absorb rainfall, thus increasing runoff and erosion. Plants have difficulty in compacted soil because the mineral grains are pressed together, leaving little space for air and water, which are essential for root growth.

soil scuffing — a mechanical method of site preparation that breaks up the surface of the soil to facilitate seed germination.

songbird (also see passerine) — a small bird, usually in the Passeriformes order (perching birds). Songbirds include well-known birds such as cardinals, sparrows, and bluebirds. Larger birds, such as hawks, owls, ducks, and herons are not songbirds. Songbirds have developed vocal organs that permit them to link various notes and sounds into a musical call or song.

source-sink dynamics — the relationship between a network of habitat patches of varying quality termed sources and sinks, which are linked by dispersal. Sources are high quality habitats where populations tend to increase, while sinks, are low quality habitats that, on their own, are unable to sustain populations. Source habitats, typically larger woodlots, provide excess individuals to the neighbouring sinks, typically smaller woodlots, thus sustaining the sink populations.

special concern — any native species that is not yet endangered or threatened, although it is uncommon, or has unique or highly specific habitat requirements or threats that deserve careful monitoring of its status.

species at risk — any species that is designated as endangered, threatened, or vulnerable by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) under the *Endangered Species Act*. Overall, these species are of conservation concern and are at varying levels of risk of becoming extinct.

species diversity (richness) — the number of different species present in a community or a given area.

stand — a contiguous group of trees sufficiently uniform in age class, composition, arrangement, and condition to be distinguishable as a group from the forest or other growth on the adjoining area.

stand improvement — an intermediate treatment made to improve the composition, structure, condition, health, and growth of a timber stand. Typically involves thinning to remove poor quality and diseased trees and improve stand health.

steward — an individual who manages property.

stewardship — the wise management and use of forest or other natural resources to ensure their health and productivity for the future with regard for generations to come.

stick nest — a type of nest built with large twigs and sticks by large birds of prey such as hawks, owls, ravens, and crows. Birds usually build these nests in a crotch near the canopy of a large diameter living tree. They are rare habitat features that are used repeatedly.

stopover areas — a habitat or natural area that consistently provides migrating birds with the opportunity to feed (refuel), obtain shelter, and rest.

structure — landscape structure is determined by the composition, configuration, and proportion of different patches across the landscape. Vegetation and forest structure refer to the horizontal and vertical distribution of layers in a forest, including height, diameter, pattern of openings, and species present in a given area.

succession — the natural and gradual replacement of one plant community (and the associated fauna) by another over time and in the absence of disturbance.

Glossary of Terms

successional stages — an identifiable stage of development of a plant community as it moves along from bare ground to a climax. Includes early-, mid-, and late-succession.

supercanopy tree — large, living trees that project above the height of the main canopy of a stand. White pine is a common supercanopy tree species in central Ontario.

sustainable — capacity to maintain a certain process or state for an indefinite period without damaging the environment, or without depleting a resource.

symbiosis — a close, mutually beneficial, often long-term relationship between two, or more, groups of organisms.

tending — operation carried out for the benefit of a forest crop or an individual, at any stage of its life. Usually involves removing competing vegetation during regeneration by cutting, or herbicides application.

territory — an area actively defended by an organism against members of the same species or occasionally animals of other species. Male birds typically defend territories by singing, but will also use aggressive postures or even attack if another bird of the same species breaches their territory.

thinning — removal of selected trees from a stand to accelerate diameter growth and improve the average form of the trees that remain. Thinning decreases resource competition and increases growth rate.

threatened — any native species that, based on the best available science, is at risk of becoming endangered if limiting factors or threats are not reversed, or populations continue to decline.

threshold — the point at which an effect or change can be detected.

unaltered habitat — natural habitat that has not been influenced by human activities such as logging or development.

under stocked — an area having insufficient trees to meet a desired management objectives (wildlife or timber). It may be lacking in trees of all sizes or from a particular size. For example, stands harvested by diameter-limit will be under stocked in large trees greater than 50 cm dbh.

understorey — vegetation (herbs shrubs, seedlings, saplings, small trees) within a forest stand. In our case we include an intermediate storey above the understory and below the overstorey (canopy).

uneven-aged management — the removal of individual or groups of trees to create a multi-aged forest stand in the future.

ungulate — a group of mammals with hooves, includes deer and moose.

upland forest — a broad class of forest, opposed to a lowland forest, consisting of dry to moderately moist soils and higher canopy coverage. Upland forest stands usually include sugar maple and beech.

urban sprawl — the gradual spreading of a city and its suburbs over the surrounding rural land, at the fringe of an urban area.

urbanization — the conversion of land into built up cities and urban areas.

vernal pool — small, shallow, temporary pools of fresh water present in spring and fall (filled by snow melt and rain), which do not support fish, but are used by many insects and amphibians for breeding.

vertical structure — the arrangement of plants in a given community from the ground (herbaceous and woody shrubs) into the forest canopy.

vertical (structural) diversity — the complexity of vertical layering in the forest. High vertical structural diversity is characteristic of old growth forests that have abundant vegetation in each layer (e.g., groundcover, sapling, and understorey).

viable population — a population of plants or animals of sufficient size and distribution to maintain its existence over time despite normal fluctuations in population levels.

vulnerable species — a term that has now been replaced by species of special concern.

wetland — any area that is flooded for at least part of the year by surface or ground water and supports an abundance of vegetative or aquatic life. Wetlands include swamps, marshes, bogs, wet meadows, river overflows, mud flats, and natural ponds.

wildlife tree — any tree used by wildlife for food or shelter. This includes any standing live or dead tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife. Characteristics include trees that produce mast, have stick nests, super-canopy trees, and those with cavities.

wintering area — the geographic location where a species spends the winter. Deer wintering areas typically include area of dense conifers.

wintering ground — the geographic location where a migratory species spends the winter months during the non-breeding season.

woodland — synonymous with forest, any land covered with trees and shrubs.

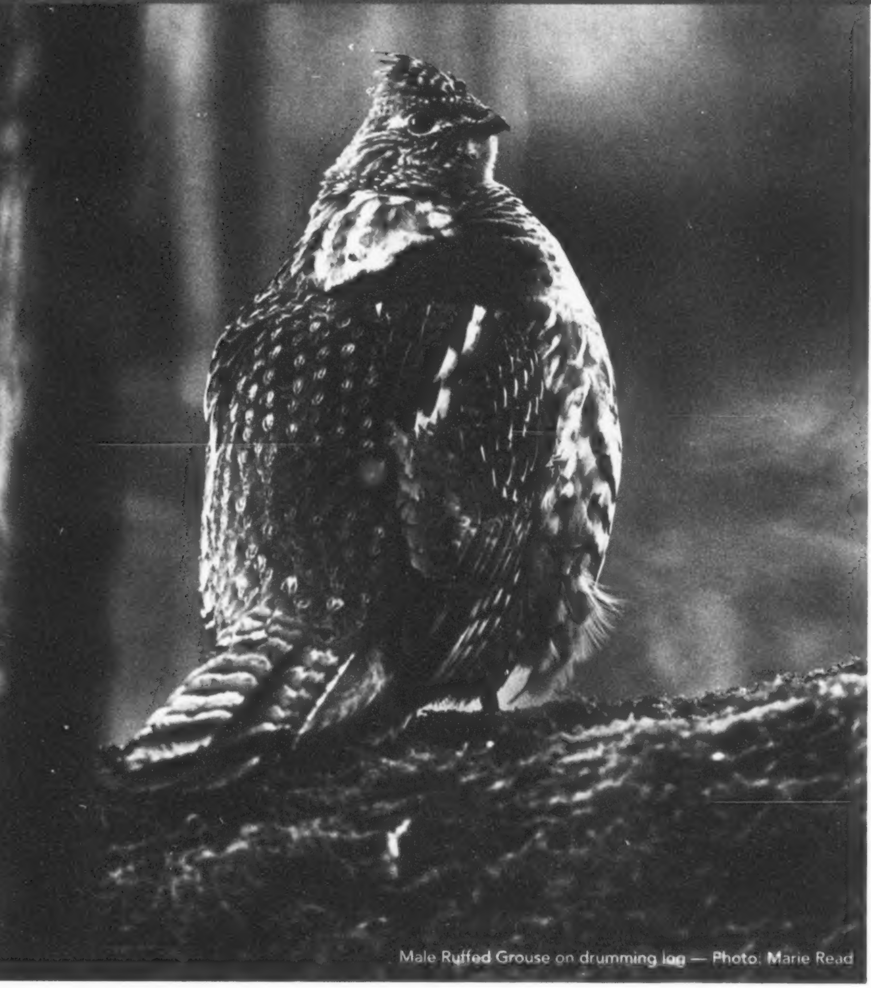
woodlot — a segment of forest, or woodland, usually privately owned, that is capable of producing forest products such as merchantable timber or maple syrup, as well as recreational uses such as bird watching or hiking.

woody plant — any plant that has a permanent above ground stem that is covered by a layer of thickened bark. All trees, shrubs and vines are woody plants, whereas all herbs are not.

Chestnut-sided Warbler — Photo: Brad Woodworth

Bird Species Accounts

Ruffed Grouse *Bonasa umbellus*


Male Ruffed Grouse on drumming log — Photo: Marie Read

Identification (40–50 centimetres)
The Ruffed Grouse is a cryptic chicken-sized, thick-bodied, game bird that spends most of its time on the forest floor. Many people's first experience with the Ruffed Grouse occurs when it explodes from the ground in a flurry of wings. Otherwise, the grouse's cryptic coloration and slow, deliberate walk make it virtually invisible. Although it is capable of rapid flight, it rarely flies more than a few hundred metres at a time. The Ruffed Grouse is grey and brown, mottled with dark and light spots. It has feathered legs, a small crest, a dark neck ruff, dark barring along the flanks, and a round tail with a dark band near the outer edge. The sexes are similar in appearance although the male is slightly larger with a more prominent crest, ruff, and tail.

Conservation Status
The Ruffed Grouse does not migrate and, once established, lives all its life within a few hectares. Though common throughout most of Canada, it is absent or declining in areas dominated by agriculture and urban centres. Breeding Bird Survey data indicate that numbers of Ruffed Grouse have declined in Canada by 2.6 percent annually since 1968. Throughout most of its range, populations of Ruffed Grouse increase and decrease on an eight to 11 year cycle. These cycles are correlated with snowshoe hares. When hare populations are high, predator populations increase too. When the hare numbers go down, the predators must find alternate prey and turn to grouse, decreasing their numbers. These cycles appear to be little affected by hunting. However, heavy harvesting of Ruffed Grouse from isolated patches appears to have led to its extirpation in southern portions of its range. Population limits seem to be mostly effected by aging and succession of forests and availability of suitable habitat. The distinctive drumming of the Ruffed Grouse is a sound heard in fewer and fewer locations as suburban sprawl, forest fragmentation, and expanding agriculture and commercial development rob this elusive game bird of habitat. Eastern populations are likely to continue to decline as deciduous forests mature and are fragmented by rural and suburban development.

Breeding Biology
The Ruffed Grouse is resident in deciduous and mixed forests in central Alaska, throughout Canada, and southward to northern California, Utah, and northern Alabama. During the breeding season, males attract females and warn off other males by making a drumming sound with their wings, often while standing on a downed log. Receptive females will visit a territory to copulate, but do not remain there. In fact, they may visit many other males before going off to a new area to build a nest and raise young on their own. In Ontario, the Ruffed Grouse breeds from late April through early July, raising a single brood. The female lays nine to12 white to buff coloured eggs that are plain or occasionally spotted. The nest is built on the ground in a shallow depression and is typically placed at the base of a tree, stump, boulder, or in a brush pile. The nest site is usually in an area that is fairly open at ground level to allow for a good view of surroundings and potential predators. Young leave the nest within 24 hours and feed themselves, though they remain close to the protective female for several weeks.

Diet

The Ruffed Grouse diet is composed of about 80 percent plant matter and 20 percent animal matter. Its main food consists of buds, twigs, catkins, leaves, ferns, soft fruits, acorns, and some insects. It forages mostly on and near the ground, but can often be seen feeding on buds and catkins in trees.

Management Guidelines

The Ruffed Grouse inhabits early to mid-successional habitats in deciduous, coniferous, or mixed woodlands. Optimal habitat includes mixed hardwoods dominated by aspens and poplars, maturing conifers, open areas, and brushy areas. Silviculture practices that benefit Ruffed Grouse include removing small patches through group selection or small clear cuts to create edge habitat and brushy cover. Prescribed burning can be used to maintain the early successional condition of these patches. Cutting and burning should be used in moderation to create a variety of successional stages and maintain patches of early to mid-successional habitat.

How to Find

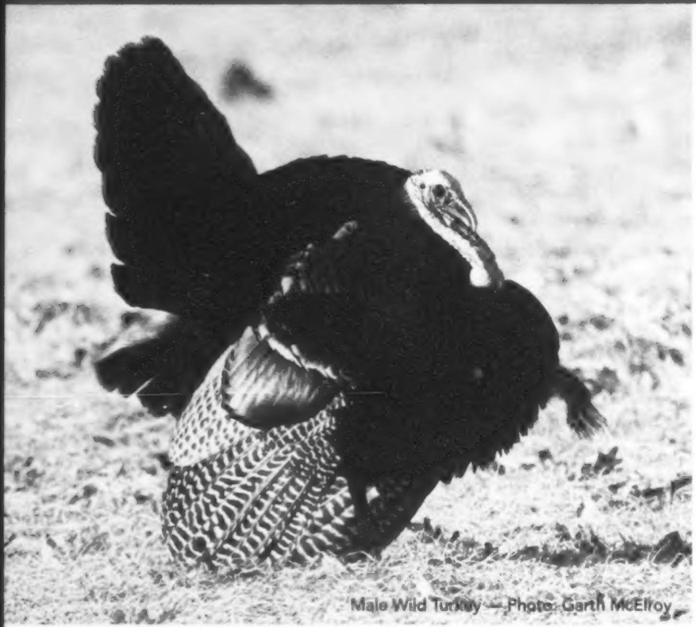
The cryptic colouration and slow walk of the Ruffed Grouse make it rather difficult to spot. Its presence is usually only given away by its sudden flushing from the ground upon close approach. In spring, it is easier to listen for the "drumming" sound of the male grouse, which can carry a considerable distance through the forest. Look for a prominent log, stump, or rock in the vicinity of this sound and you may see him perched on it, beating his wings.

Did you know?

- Grouse have the ability to digest plant matter with high concentrations of bitter and toxic chemicals. This ability allows them to survive on aspen buds during harsh winters when there is little else to eat.
- Ruffed Grouse can swim short distances.
- Ruffed Grouse will often roost beneath the snow on cold winter nights.
- The Ruffed Grouse grows comb-like projections on its toes in the winter. It has been suggested that these projections may act like snow shoes!

Photo: Brad Woodworth

Wild Turkey *Meleagris gallopavo*



Male Wild Turkey — Photo: Garth McElroy

Identification (110–115 centimetres)

The Wild Turkey is a large, rather awkward ground-dwelling bird capable of making powerful short-distance flights. It is a resilient, prolific and strikingly handsome bird with long legs, long neck and a large fan-shaped tail. Turkeys are black to blackish-bronze with white wing bars, black and brown tail feathers, and a featherless bluish-gray to reddish head and neck (depending on the bird's emotional state). "Toms" or males are more iridescent than females and sport a hair-like beard which protrudes from the breast bone. Females, called hens, are smaller and duller with bare grey heads and feathered necks. Turkeys are gregarious through most of the year, bar the lone incubating female. They are promiscuous, and one tom will often mate with many hens.

Conservation Status

Prior to European settlement, the Wild Turkey was abundant and widespread throughout eastern North America in hardwood and mixed forests with scattered openings. Unregulated hunting and habitat loss, however, led to extirpation from Ontario by 1909. A restoration program, which began in 1984, has successfully restored turkey populations in the province. In North America, populations have increased by 12.9 percent annually since 1968, and have even expanded west beyond their historical range.

Breeding Biology

This permanent resident breeds from southern Ontario, Alberta, Saskatchewan, and Manitoba southward throughout the US states and down to central Mexico. In early spring, turkeys disband from their winter flocks to form smaller breeding groups with one or more males and several females. These males challenge each other and the dominant male gains access to the females. Females nest in a shallow depression on the forest floor, usually at the base of a tree or under a brush pile, bush, or thick vegetation. Turkeys are single-brooded, laying 10 to17 whitish eggs, speckled with brown.

Diet

The Wild Turkey is omnivorous. In fall and winter, they feed on acorns, beech nuts, bulbs, seeds, and fruits of shrubs and trees. In spring and summer, they switch to predominantly grass and sedge seeds, and consume small amounts of insects (beetles and snails) and small vertebrates (salamanders and snakes).

Management Guidelines

Because Wild Turkeys use a variety of habitats throughout the year for food, shelter, and cover they need a landscape that includes a mix of forest and open areas. Management for turkeys can include maintaining patches of dense conifer for roosting and to allow for patches of reduced snow depths that ease winter movements, retaining both soft and hard mast producing plants for food, thinning to promote growth of foraging habitat, maintaining mixed stands of variable age, applying prescribed burns or group selection to stimulate fruit-bearing shrub and understorey growth, and ensuring that harvests protect spring seepages that provide turkeys with a source of water during the winter.

How to Find

Although the Wild Turkey is a large ground-dwelling bird, it can be rather elusive. Look for small groups feeding in agricultural fields on the edge of woodlots in the early morning or listen for its gobble in the spring.

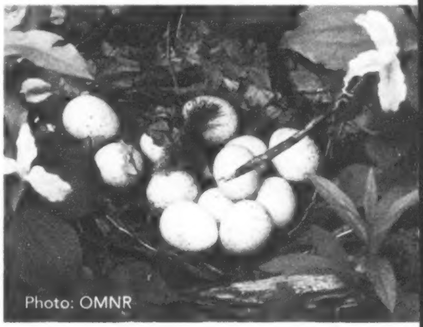
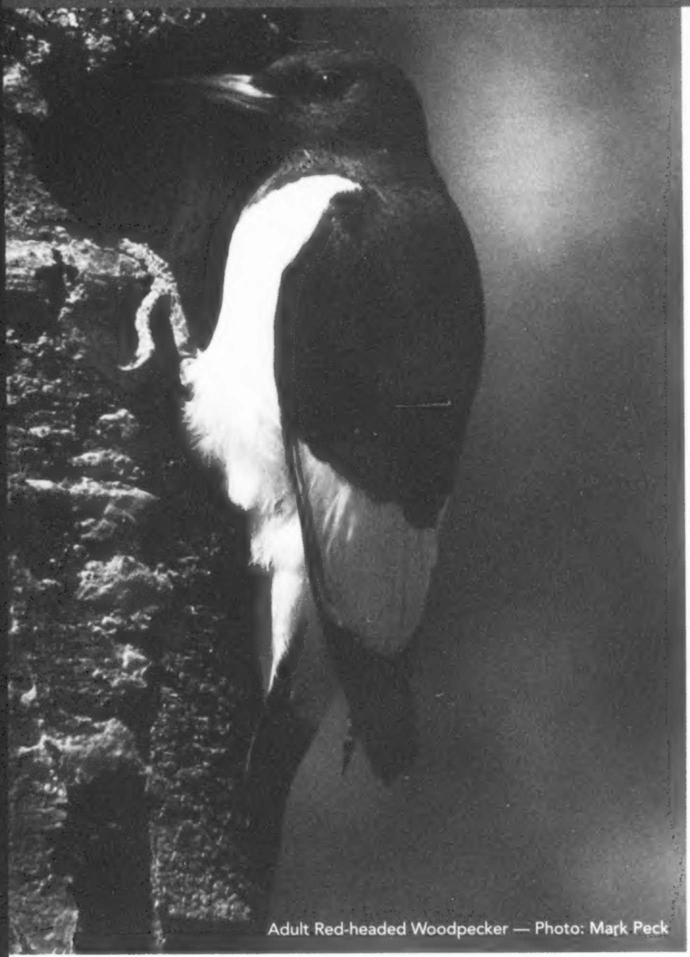


Photo: OMNR

Did you know?

- Turkeys can swim short distances.
- Wild Turkey males mate with several females (polygyny). Males attract females by gobbling and strutting with their tail fanned out, their wings lowered and dragging on the ground, their back feathers erect, their head thrown back, and their crop inflated.
- Although hens build their own nests and incubate their own young, they are also known to frequently "dump" some of their eggs into another turkey's nest.
- The Wild Turkey was almost the national bird of the United States, losing out to the Bald Eagle by one vote.

Red-headed Woodpecker *Melanerpes erythrocephalus*



Adult Red-headed Woodpecker — Photo: Mark Peck

Identification (19–23 centimetres)
The Red-headed Woodpecker is striking at rest and in flight, showing its colors of red, black, and white. This bird is unmistakable, with a head that is entirely crimson red, contrasted by a black back, and a white belly, rump, and large wing patch. The sexes are identical.

Conservation Status
Over the last 200 years, this species has undergone periods of abundance and periods when it appeared to be on the verge of extinction. The Red-headed Woodpecker breeds in open woodlands, particularly with beech or oak, and is of high conservation concern due to precipitous declines throughout most of its range in recent decades. In Canada, this species is threatened, and has declined in southern Ontario from 10,000 pairs in the 1980s to an estimated 700 pairs today. Declines may be linked to loss of dead elm trees for nesting and competition with Red-bellied Woodpeckers for nest cavities.

Breeding Biology
The Red-headed Woodpecker breeds from southern Saskatchewan, Manitoba, Ontario and Quebec south through the eastern United States in open woodland, woodland edges, urban parks, and fencerows. In Ontario, it breeds from early May through July. It lays five white eggs and raises a single brood. Birds typically excavate a new nest cavity each year in dead or dead portions of live trees at mid canopy height, but will reuse their own nest or those of other species. Red-heads are aggressive and exhibit high nest site fidelity, often nesting in the same limb in successive years.

Diet
The Red-headed Woodpecker is the most expert and persistent "flycatcher" in its family, and the most omnivorous North American woodpecker. It consumes beech and oak mast, seeds, nuts, berries, fruit, insects, bird eggs, nestlings, and mice. They forage primarily on dead trees, but will also forage on the ground, and catch insects in the air.

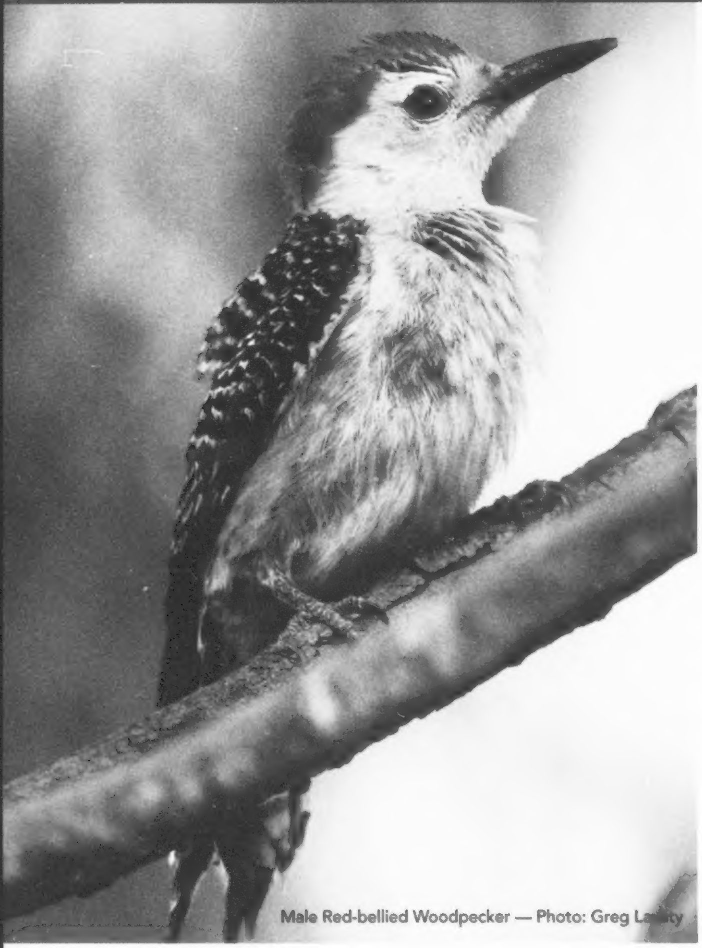
Management Guidelines
As with many cavity-nesting birds, availability of snags for nesting and roosting is of prime importance in the conservation and management of Red-headed Woodpeckers. Retaining existing snags and other live cavity trees and declining trees as future snags, in conjunction with providing open habitat to facilitate flycatching (e.g., possibly group selection) will benefit this species. More research is needed to identify precise habitat relationships and sensitivity to silviculture and other landuse practices in order to conserve future populations.

How to find?
Look for Red-headed Woodpeckers in open woodlands, high in the canopy foraging for mast (oak, beech, hickories). Listen for the distinct nasal "queer queer" call.

Did you know?

- The Red-headed Woodpecker may forego migration in the northern part of its range if the winter is mild and mast is abundant.
- Red-headed Woodpeckers hide insects and seeds in cracks in wood, under bark, in fence posts, and under roof shingles. They typically cache grasshoppers tightly into crevices while still alive but unable to escape.
- These birds are aggressive and are known to attack other birds invading their territory, and will even destroy the eggs and nests of other species.

Red-bellied Woodpecker *Melanerpes carolinus*



Male Red-bellied Woodpecker — Photo: Greg Lavaty

Identification (23–26 centimetres)

Despite the reddish-pink wash on its belly, the Red-bellied Woodpecker is best known for its red hood and zebra patterned back. The red extends all the way to the forehead in the males, but is restricted to the nape in the females. This medium-sized woodpecker frequents bird feeders during the winter.

Conservation Status

The Red-bellied Woodpecker is a permanent resident across its range. It is widely distributed across the eastern U.S, but restricted in Ontario to the Carolinian region. Its range has expanded dramatically north and west in recent decades due to forest maturation and the increased availability of backyard feeders. This woodpecker directly competes with European Starlings for nest cavities, and is often evicted by starlings.

Breeding Biology

This highly vocal species breeds within relatively mature hardwoods and mixed woods where large-diameter trees are present. Red-bellied Woodpeckers typically excavate a new nest cavity each year, usually high in the canopy, in dead or declining large-diameter trees. They often return to the same tree stub or limb to nest in successive years, beginning their new nest below the previous year's nest. In Ontario, they breed from May to July, laying clutches of four white eggs, and raising a single-brood.

Diet

Unlike most woodpeckers, the Red-bellied seldom excavates wood for insects. Instead, it is a generalist, consuming fruit, mast and seeds in quantity, along with bark and leaf insects. It opportunistically feeds on Yellow-bellied Sapsucker "sap wells," nectar, bird eggs and nestlings, and small vertebrates. They store nuts, corn, seeds, berries and insects for the winter.

Management Guidelines

Their generalist nature and tolerance of humans suggests that management for this species is not a concern. Yet, their reliance on large declining and dead trees for nesting and roosting means that forest management programs targeting the removal of these suitable-sized trees limit this species. In fact, in the Carolinian region, declines in density have occurred in response to recent silviculture practices. Provision of mast producing trees by forest managers could benefit this woodpecker.

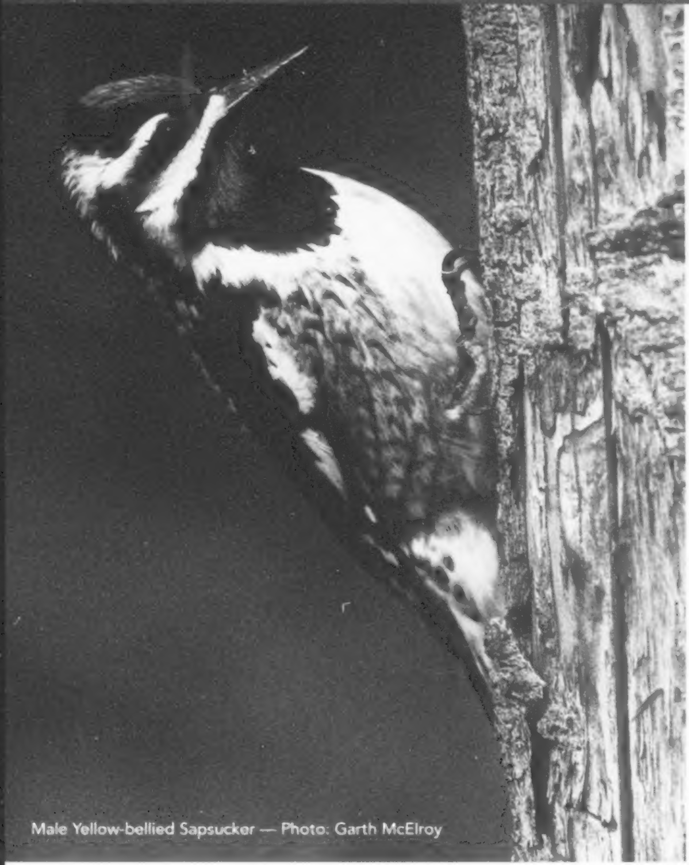
How to find

If you live close to a deciduous forest in southern Ontario, you may well see this bird during the winter at your bird feeder. Otherwise, the best time to spot a Red-bellied Woodpecker is in late April when birds are engaged in pair formation and cavity excavation. At this time, birds are highly vocal and will call almost constantly. Look for males calling, while peeking out of their cavity.

Did you know?

- The Red-bellied Woodpecker is poorly named, as the "red belly" is limited to a small section of its underbelly that is difficult to see in the field.
- Simultaneous nesting in the same tree has been recorded with the European Starling, Yellow-bellied Sapsucker, Northern Flicker, Red-headed and Hairy Woodpecker.
- The male has a longer bill and a longer, wider tongue allowing him to reach into furrows to extract prey that is not accessible to females. This may permit the sexes to divide up the resources in one area.
- A group of woodpeckers can be called a "descent," "drumming," or "gatling."

Yellow-bellied Sapsucker *Sphyrapicus varius*



Male Yellow-bellied Sapsucker — Photo: Garth McElroy

Identification (20–23 centimetres)

Though not well known to many people, the Yellow-bellied Sapsucker is a widespread and common woodpecker that plays a vital ecological role in the forest communities it inhabits. It creates rows of shallow holes (*sap wells*) in the bark of trees that supply a sweet liquid meal for sapsuckers and some other species like hummingbirds. It also excavates tree cavities that are exploited by numerous other bird and wildlife species. The sapsucker has a red forehead, two white head stripes, a long white wing stripe, black and white barring on the back, a black bib, and a faint yellowish wash on the belly. Males have a red throat that is white in females.

Conservation Status

The Yellow-bellied Sapsucker is a common and widespread short-distance migrant, with overall stable populations. Populations in the Carolinian region of Ontario have increased due to the conversion of agriculture to young forests. Although it is believed to prefer young forests, its occurrence in southern Ontario tends to be mostly in areas of older forest. Habitat quality appears to be driven by their need for large declining trees with heart rot or large snags for nesting, and the construction of sap wells.

Breeding Biology

The Yellow-bellied Sapsucker breeds in a wide variety of deciduous, and to a lesser extent mixed-deciduous forests, including both young and old forests dominated by early successional or climax tree species. Breeding ranges from central Alaska east to Newfoundland, south to the northeastern United States. They typically return to the same area to breed, often to the same tree, and occasionally the same cavity. Nests are located at mid canopy, in dead or declining, large diameter deciduous trees in tolerant forests, or in live trees with heartrot in intolerant stands. In Ontario, birds breed from late April through June, lay four white eggs, and raise a single brood.

Diet

Sapsuckers are unique foragers, drilling a series of shallow holes in the bark of trees, then licking up the sap and the insects that it attracts. Half of their diet consists of arthropods, mainly ants, while the remainder consists of sap and fruit.

Management Guidelines

Despite the common belief that sapsuckers are associated with young forests and edges, they exhibit sensitivity to logging. Birds tend to be absent from woodlots subject to heavy partial-harvesting (such as diameter-limit cuts) and in southern Ontario, densities are highest in mature stands. Like other cavity nesters, this species is dependent on mature, dead and declining trees and snags for nesting and construction of sap wells.

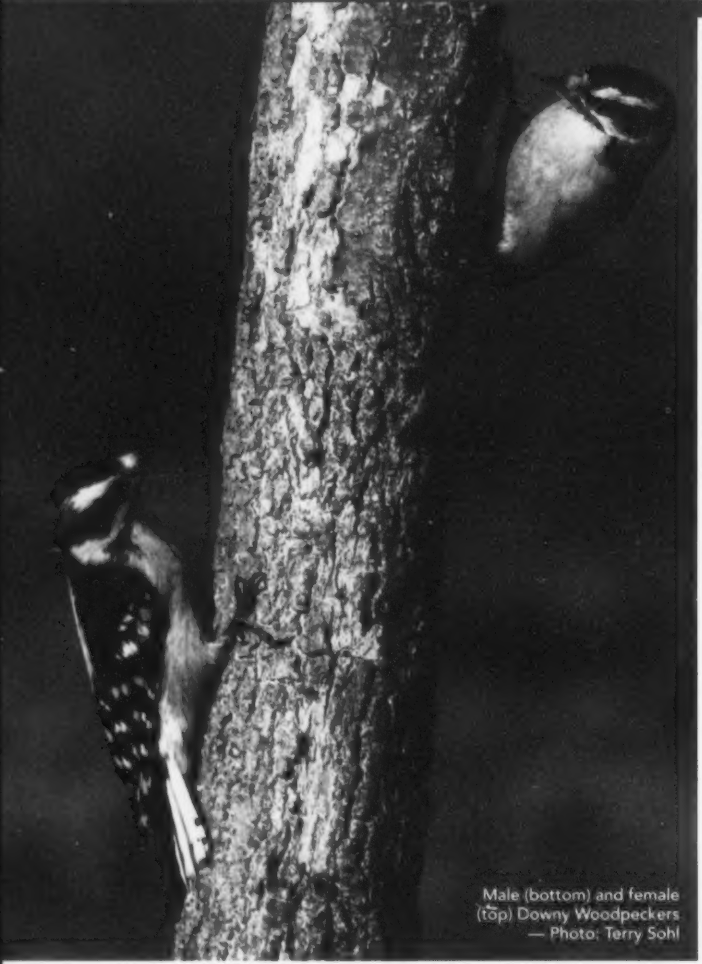
How to find?

The species is most easily detected by its distinctive vocalizations and drumming. Listen for their unique, slow irregular tapping (easily imitated by tapping on a tree with a stick), and their nasal "mew" calls. Look for Yellow-bellied Sapsuckers drilling and maintaining sap wells at mid-canopy levels.

Did you know?

- Ruby-throated Hummingbirds appear to be closely associated with sapsuckers. They will place nests near sap wells, follow sapsuckers in their daily movements, and may even time their migration to coincide with that of sapsuckers. They are one of a suite of species that feed at sap wells.
- The red cap on some females may be diminished or completely absent, making them look somewhat like a female Hairy Woodpecker.
- This is the only woodpecker in eastern North America that is completely migratory.

Downy Woodpecker *Picoides pubescens*



Male (bottom) and female (top) Downy Woodpeckers
— Photo: Terry Sohl

Identification (14–17 centimetres)

The Downy Woodpecker is the smallest and perhaps most familiar woodpecker in North America. It has a white belly and back, and black and white checked head, tail, and wings. Adult males have a red patch on the back of the head which females lack, while juveniles have a red forehead. It is distinguished from the Hairy Woodpecker by its smaller body size and bill, and black barring on the white outer tail feathers.

Conservation Status

The Downy Woodpecker is widespread and common throughout its range, owing to its broad habitat tolerances. It is equally at home in urban woodlots or wilderness forests and is readily attracted to backyard feeders. Overall populations are generally stable or slightly increasing.

Breeding Biology

Downy's are year-round residents coast to coast; from the tree line in Canada and Alaska to southern Florida and California. They breed in a variety of successional deciduous and mixed wood habitats, forest edges, riparian areas, and even urban neighbourhoods, orchards, and parks. In Ontario, birds breed between early May to early July, lay four to five white eggs, and raise a single brood. The cavity is typically located on the underside of a dead branch on a live or dead tree.

Diet

The Downy Woodpecker consumes approximately 75 percent animal matter and 25 percent plant matter. It forages for insects on the surface and shallow subsurface of tree branches and trunks by gleaning, probing, prying, tapping, and excavating. Foods include beetles, ants, caterpillars, acorns, berries, sap, and larvae from weed stem galls.

Management Guidelines

Due to its preference for open woodlots and early second growth habitats, the Downy Woodpecker benefits from thinning practices. However, extensive clearing or intensive, even-aged practices are detrimental to Downy populations because of the resulting loss in suitable nest trees. As the smallest North American woodpecker, the Downy can drill cavities in dead trees or limbs that measure as little as 10 centimetres around. This means that it can live in a wider range of habitat than larger woodpeckers, which require bigger trees in which to create their nests. Optimal forest habitat has a basal area of 10 to 20 m^2/hectares where a collection of existing cavity trees, snags and lower quality trees are retained.

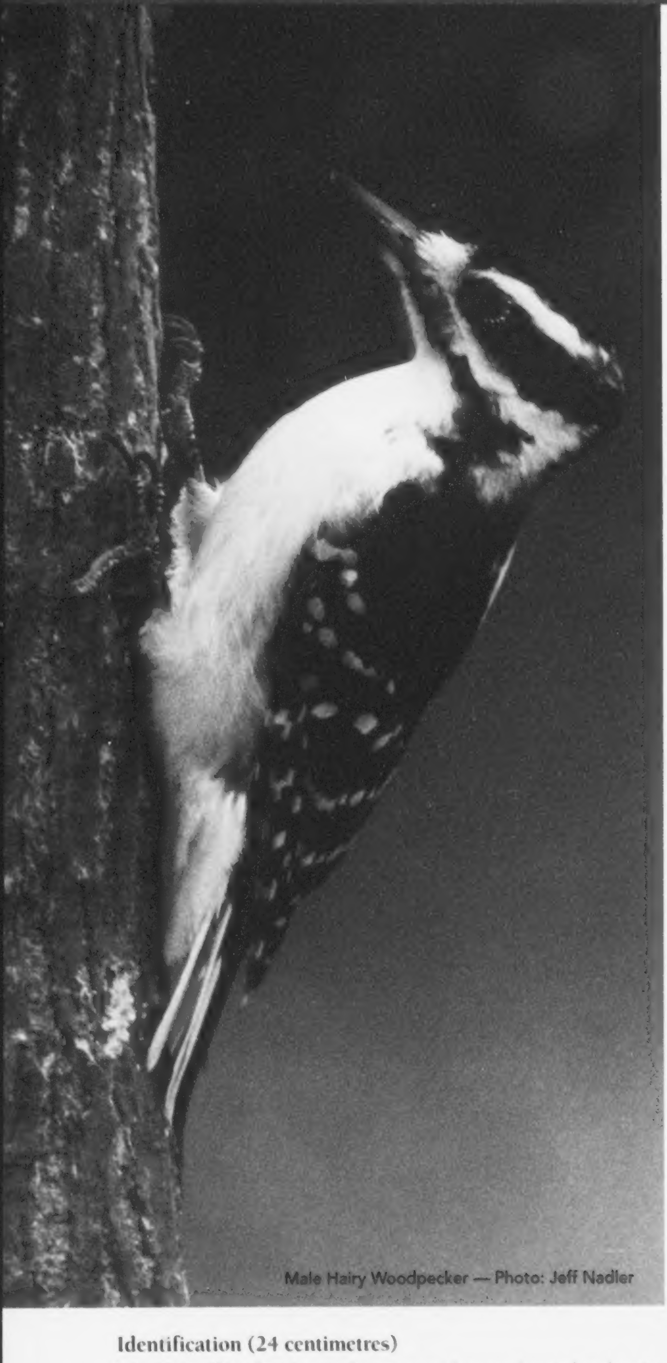
How to Find

The Downy Woodpecker is a common visitor to back-yard birdfeeders, but it may also be found in urban treed areas and open woodlots. Listen for its loud descending whinny and its sharp pik call note.

Did you know?

- The male and female excavate a nesting cavity together over the course of seven to 20 days.
- The male is in charge of incubating and brooding at night and is primarily responsible for keeping the cavity sanitary.
- This species may forage next to Pileated Woodpeckers or follow nuthatches to steal missed or stashed foods.
- Diet and foraging techniques vary with season and sex. Sexes may stay in the same areas in winter, but they divide up where they look for food. Males tend to forage more on smaller branches, females more on larger branches and trunks of trees.

Hairy Woodpecker *Picoides villosus*



Male Hairy Woodpecker — Photo: Jeff Nadler

Identification (24 centimetres)
The Hairy Woodpecker is the most widespread woodpecker in North America. This medium-sized bird has a white back and belly, black wings with white spots, two white stripes on the head, and a long thick bill. Males have a red patch on the back of their head, which females lack. Away from feeders, the Hairy Woodpecker is shy, and prefers mature forests.

Conservation Status
A common and widespread forest-interior species, the Hairy Woodpecker is associated with mature forests and generally avoids agricultural and urban areas. In Ontario, the largest densities occur in the southern shield, where forest cover is extensive. Both the Ontario atlas and BBS data show population increases.

Breeding Biology
Hairy Woodpeckers occur in forests across North and Central America from the near northern limit of the boreal forest in Canada, south to Panama. They typically nest in large tracts of mature deciduous or mixed forests, excavating a new nest each year. Nests are often in the trunk of live, large-diameter trees with diseases such as fungal heart rot. In Ontario, Hairy's breed between late April and July, lay four white eggs, and raise a single brood.

Diet
Hairy Woodpeckers feed primarily on insects located on the bark surface and subsurface by chipping and chiselling into the tree. To a lesser extent, they feed on a variety of fruits and seeds.

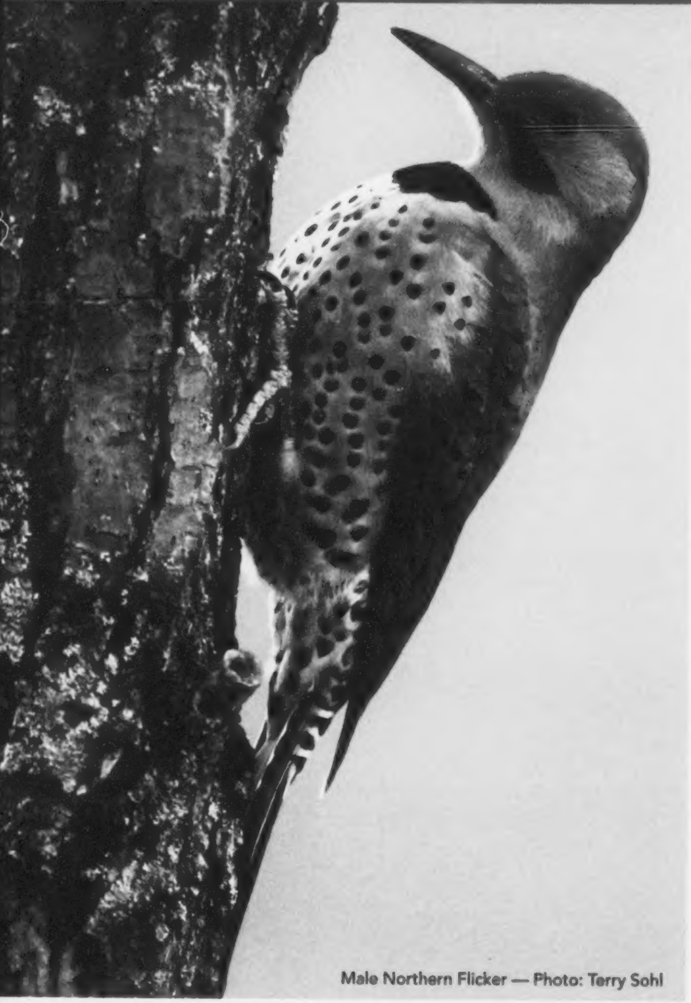
Management Guidelines
Hairy Woodpeckers decline in areas suffering a loss and fragmentation of mature forest habitat. Since this species depends on large tracts of mature forest, intense forestry practices such as diameter-limit and clear cutting fail to provide suitable habitat, even where snags are retained. Large forest areas that are left uncut will provide the best breeding habitat for Hairy Woodpeckers. That said, this species appears resilient to selection harvesting when silvicultural and habitat guidelines are adhered to, since these retain suitable densities of declining cavity trees.

How to find
Hairy Woodpeckers can be wary of people, and are less commonly seen at feeders than the Downy. You are most likely to spot one in a mature forest in the early spring when they are most vocal. Listen for the "peek" call and their repeated, emphatic "whinny" or rattle.

Did you know?

- **Some Hairy Woodpeckers will remain paired year-round, although pairs are typically formed each spring.**
- **The similar looking Hairy and Downy woodpeckers occur together throughout most of their ranges. The Downy Woodpecker uses smaller branches, while the Hairy tends to spend more time on the trunk. It was originally thought that the larger Hairy Woodpecker excluded the smaller Downy from more productive foraging spots, but it appears that just the reverse is true.**

Northern Flicker *Colaptes auratus*



Male Northern Flicker — Photo: Terry Sohl

Identification (28–31 centimetres)

This common ant-eating woodpecker, ranges across the forested part of North America. In the east, it has yellow feathers on the underside of the wing and tail visible during flight (reddish in the west). Males have a black "moustache" that is absent on females. Otherwise, both sexes are barred black and brown on top, spotted with black below, and have brown faces, grey heads, a red crescent on the nape, a black crescent on the upper breast, and a conspicuous white rump.

Conservation Status

The Northern Flicker is widespread and common, yet populations have declined by 70 percent over the last 35 years, placing it as a species of regional concern. It occurs throughout most wooded regions of North America, and is a familiar bird in many suburban environments. It breeds in most forest types, relying on large diameter dead and declining trees. Ontario densities of Northern Flickers are highest in the boreal and lowest in the Carolinian region. Habitat loss, competition for nest sites with European Starlings, and decreased availability of suitable nest sites have contributed to its decline.

Breeding Biology

Flickers function as both a primary and secondary cavity-nester, capable of excavating new nests each year but also nesting in natural or old woodpecker cavities. They breed in openings and edges of deciduous and mixed-woods, including burned areas and clearcuts if snags are retained. Northern Flickers breed in Ontario between late-April and mid July, laying seven to eight pure white eggs, and raising a single brood. In southern Ontario, they prefer to nest in the mid-storey in large diameter, dead, soft maple trees.

Diet

Northern Flickers feed principally on ants but also take other insects, fruit, seeds, and berries. They feed primarily on the ground, digging in the dirt and on downed logs to find ants, and use their long barbed tongue to lap them up.

Management Guidelines

As a species dependent on large diameter dead and declining trees, retention of snags and declining cavity trees during harvesting will benefit flickers. Unlike many forest species, increased residential development and fragmentation have increased the amount of habitat for flickers. They play an important role in forested ecosystems by excavating nesting and roosting holes that are subsequently used by many other birds and mammals that cannot make their own.

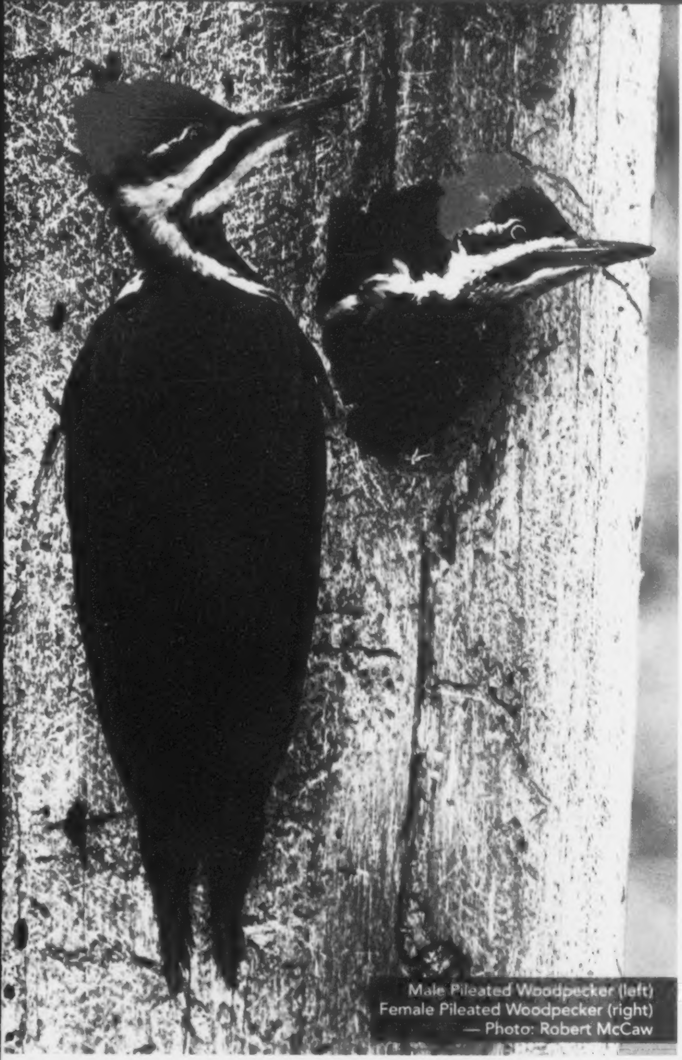
How to Find

One of the best ways to spot a Northern Flicker is to listen for its loud kick, kick, kick or wick-a-wick-a-wick-a call from the top of a dead snag. Look for the bird's undulating flight and prominent white rump.

Did you know?

- The Northern Flicker is one of the few North American woodpeckers that is strongly migratory. Most birds in the northern parts of the range move south for the winter.
- Flickers are easily identified by their strong undulating flight and prominent white rumps.
- Although it climbs up tree trunks and hammers on wood like other woodpeckers, the species prefers to find food on the ground. Ants are its favorite food.
- Flickers make a loud whinny call that sounds somewhat like laughter and is often confused with the Pileated Woodpecker.

Pileated Woodpecker *Dryocopus pileatus*



Male Pileated Woodpecker (left)
Female Pileated Woodpecker (right)
— Photo: Robert McCaw

Identification (40–49 centimetres)

The Pileated Woodpecker is the largest woodpecker in Canada. Its loud ringing calls and large, rectangular feeding excavations in dead trees announce its presence in forests across much of the continent. The majority of its body is black, and a large white patch on the underside of each wing is visible during flight. It has a prominent red crest, white throat, and a white streak extending from the bill, across the cheek and down the neck. Males have a red "moustache," while that of females is black.

Conservation Status

Pileated Woodpecker populations declined greatly with the clearing of the eastern forests. The species rebounded in the middle 20th century, and has been increasing slowly but steadily across most of its range. In Ontario, the Pileated's distribution is patchy in the Carolinian region, where forest cover is low and large patches of mature and older woods are scarce.

Breeding Biology

The Pileated Woodpecker is a permanent resident of deciduous, mixed and coniferous forests in southern and central Canada and the western, midwestern, and eastern United States. Territories are naturally large, making for low densities even when populations are healthy. Nests are typically located in the mid to upper storey in dead or dead portions of live, large-diameter trees. Nest cavity entrances are large (11 x 8.5 cm) and oval shape. In Ontario, Pileated Woodpeckers breed from early May through mid-July, lay four white eggs, and raise a single brood.

Diet

Throughout the year, Pileated Woodpeckers primarily feed on insects found in dead and declining trees, and large fallen logs, particularly wood-boring beetle larvae and carpenter ants. During summer and fall, fruit and mast are also consumed.

Management Guidelines

Timber harvest has the most significant impact on habitat. Removal of large-diameter trees and downed wood, and opening of the canopy eliminates nest and roost sites, foraging habitat, and cover for Pileated Woodpeckers. Forest fragmentation reduces population density and makes birds vulnerable to predation by raptors as they fly between forest fragments. Retention of large-diameter dead and declining trees during harvesting would benefit this species. Dead trees are favoured sites in which to excavate nests and roost cavities. Availability of suitable mature forest habitat is limiting most populations.

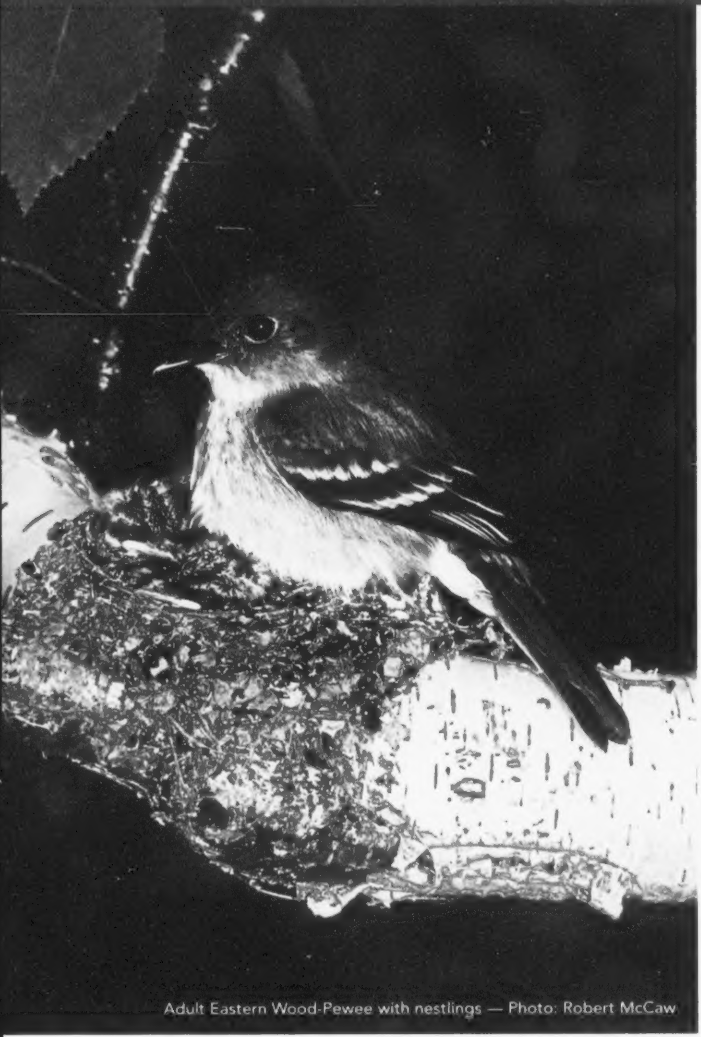
How to find

Pileated Woodpeckers can be elusive in the forest, despite their size and spectacular appearance. Listen for the loud laugh-like call "kuk kuk kuk" ringing in the forest, similar to the flicker's but louder and higher pitched.

Did you know?

- **Pairs may partially excavate a number of new "test" cavities each year prior to completing a final nest cavity.**
- **The Pileated digs characteristically rectangular holes in trees to find ants. These excavations can be so broad and deep that they can cause small trees to break in half.**
- **A pair stays together on its territory all year round. It will vigorously defend the territory in all seasons, but will tolerate "floaters" during the winter.**

Eastern Wood-Pewee *Contopus virens*



Adult Eastern Wood-Pewee with nestlings — Photo: Robert McCaw

Identification (15 centimetres)

This rather indistinct bird of the mid canopy is best known for its persistent, slurred "PEE-a-WEEE" song, heard throughout the summer. The Eastern Wood-Pewee is grey above and pale below, with a dark wash on breast and sides. It has an upright posture, slight crest on head, whitish wing bars, and an eye ring that is either faint or altogether absent. The sexes are alike.

Conservation Status

Although still considered common through much of the forested regions of eastern North America where it breeds, the Eastern Wood-Pewee has experienced significant rangewide declines over the last 25 years, believed to be linked to heavy browsing by white-tailed deer and/or changes in aerial insect populations. In Canada, rates of decline have been 3.7 percent annually.

Breeding Biology

The Eastern Wood-Pewee is one of the last migrants to return in spring, often raising two broods between early June and early August. It has an extensive breeding range, stretching from southeast Saskatchewan to Nova Scotia, extending as far south as Florida. It uses a wide variety of forests for breeding, including deciduous, coniferous, and mixed forests, as well as forest edges and riparian zones, usually with a relatively open understorey. Nests are neat, shallow cups built five to 20 metres off the ground on a horizontal limb well out from the trunk of a tree. Nests are typically covered in lichens, and resemble a knot on the tree branch. The female lays two to four eggs that are whitish in colouration with brown or purple blotches forming a "wreath" around the larger end.

Diet

The Eastern Wood-Pewee feeds almost exclusively on small flying insects, chiefly wasps, bees, and flies. Typically, it flies out from a dead exposed perch 10 to 12 metres above ground to catch a flying insect and then returns to the same perch. It occasionally gleans invertebrates off leaves or from the ground.

Management Guidelines

The Eastern Wood-Pewee does not seem to be adversely affected by forest fragmentation, as it makes use of both edge and interior habitat. Forestry practices that maintain large tracts of intermediate aged forest with pockets of small openings in an otherwise closed canopy forest would be preferred by Eastern Wood-Pewee. The regulation of deer populations at <8 deer/km² would further benefit this species, as high browsing disturbance affects the intermediate canopy, and the foraging space of this flycatcher.

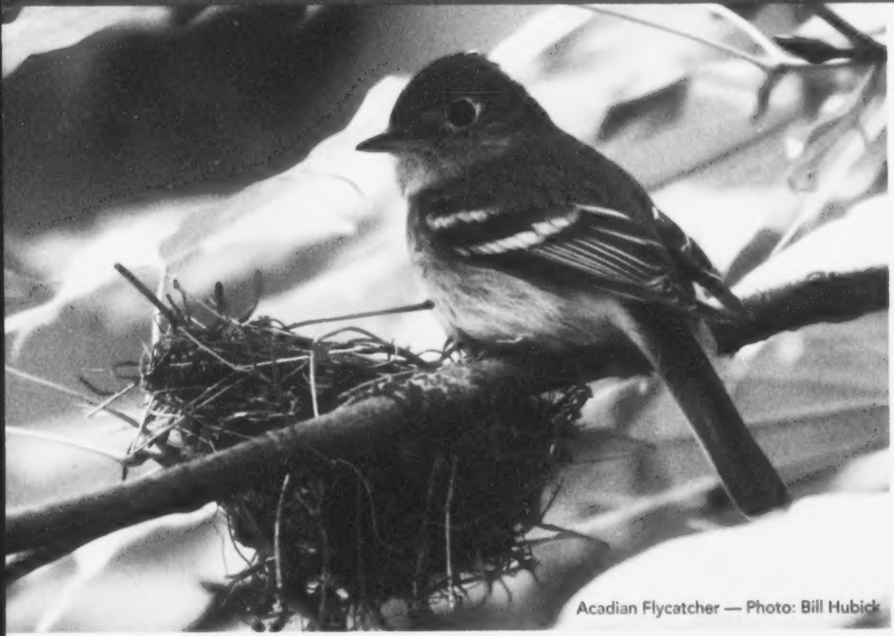
How to Find

The Eastern Wood-Pewee can be found sitting on a prominent exposed perch (often a small diameter dead branch) in the lower to mid-canopy singing or scanning for food. Just listen for this relentless singer's loud "PEE-a-WEEE" song.

Did you know?

- In a forest where several flycatcher species are found, the Eastern Wood-Pewee forages higher in the trees than the Least and Acadian Flycatchers, but lower than the Great Crested Flycatcher.
- Females reuse nests within the same season and between seasons, although frequency is low.
- A group of pewees is collectively known as a "dribble" or a "squirt" of pewees.

Acadian Flycatcher *Empidonax virescens*



Acadian Flycatcher — Photo: Bill Hubick

Identification (14 centimetres)

A denizen of large, mature, moist deciduous forests and streamsides (often with a hemlock component), the Acadian Flycatcher is typically first detected by its explosive "peet-sah" or "tee-chup" song. They are the largest and greenest of the North American Empidonax flycatchers, a group of small grey-green birds similar in appearance, but distinguishable by song and habitat. Their upperparts are greenish-olive, while their underparts have a faint yellow wash. They have a white eye-ring and throat, mostly pale (yellowish) lower mandible, and white or buffy wing bars that contrast with their dark wings. The sexes are identical.

Conservation Status

Though a widely distributed breeder in the forested landscape of the eastern United States, the Acadian Flycatcher is Endangered in Canada and restricted to the southern Carolinian forest region of Ontario. Despite stable populations, it is a species of conservation concern across much of its range due to its dependence on large mature forest and sensitivity to forest fragmentation. The Ontario population is estimated to consist of no more than 50 breeding pairs.

Breeding Biology

The Acadian Flycatcher is a long-distance migrant that winters in Latin America. On the breeding grounds, it is typically associated with water, selecting sites with high, dense canopy and an open understorey within undisturbed forest. Areas with no or little ground cover are preferred. In Ontario, it breeds from mid-May to the end of July, usually raising just a single brood. Nests are shallow, messy, frail-looking, hammock-like baskets with long dangling pieces of vegetation. They are slung in the fork of a small horizontal branch, often far out from a tree-trunk, at a height of 2.5 to 6.0 metres. Females typically lay clutches of three or four white eggs with small brownish spots.

Diet

Acadian Flycatchers eat a wide variety of insects and larvae, from ground level to lower canopy. They are passive foragers that sit on exposed branches looking for prey, snatching most insects from leaves, especially from the undersides. They also hover to glean insects, and often catch them in flight.

Management Guidelines

Emphasis should be placed on conserving large, mature tracts of forest with little internal disturbance, and maintaining canopy cover in riparian and swamp forest habitat. The highly fragmented landscape and small woodlot size in southern Ontario limit populations. Restoring and preserving large forests would not only provide good nesting habitat, but may alleviate edge-effects to increase population size and facilitate range expansion. The species is tolerant of light selection harvest, but even moderate logging within territories is expected to eliminate populations for years, if not decades.

How to find

The best way to spot Acadian Flycatchers is to listen for their explosive "peet-sah" call, then look carefully for a singing male on an exposed branch in the lower canopy.

Photo: Peter Burke

Did you know?

- Both males and females will bill-snap in response to imminent threats.
- Acadian Flycatcher nests suffer from predation rates of 50 to 70 percent.
- It is an excellent flyer, with the capability to hover and fly backwards.

Great Crested Flycatcher *Myiarchus crinitus*

Adult Great Crested Flycatcher with nestling — Photo: W. Greene/VIREO

Conservation Status

This species is widespread across southern Ontario. Like many aerial insectivores, Great Crested Flycatchers are showing population declines according to the Breeding Bird Survey. Still, it is generally holding its own, because of its wide spectrum of nesting habitats and tolerance for human activity.

Breeding Biology

The Great Crested Flycatcher breeds in open deciduous and mixed woodlands, along riparian corridors and edges, within swamps, and suburban areas. It is the only eastern flycatcher that nests in cavities. It prefers natural cavities in dead trees, often reusing a nest in subsequent years. The nest is bulky and includes materials such as leaves, grasses, hair, feathers, rootlets, bark, twigs, string, paper, and trash. One or more shed snakeskins are often included in the nest lining. In Ontario, it breeds from mid May to mid July, lays five whitish eggs heavily decorated with brown streaks, blotches, and lines, and raises a single brood per season.

Diet

The Great Crested Flycatcher is mainly insectivorous, but consumes some fruit and vertebrates. It sallies out from perches after flying insects, hovers to glean insects off leaves, and drops down from a perch to take prey on the ground. It hunts primarily in the upper canopy.

Management Guidelines

Although tolerant of most harvesting practices, dead trees (snags) or dead stubs in living trees are the nesting habitat of this cavity dependent bird and need to be retained under any management system. Open conditions associated with even-aged management may benefit Great Crested Flycatchers.

How to Find

Unless you hear its loud, harsh calls, the rather secretive Great Crested Flycatcher is easily overlooked in the canopy foliage of a suburban lot or woodland. Listen for its most frequent and most diagnostic call. A loud, harsh whistled, rising "WHEEEEEP" call readily gives its presence away.

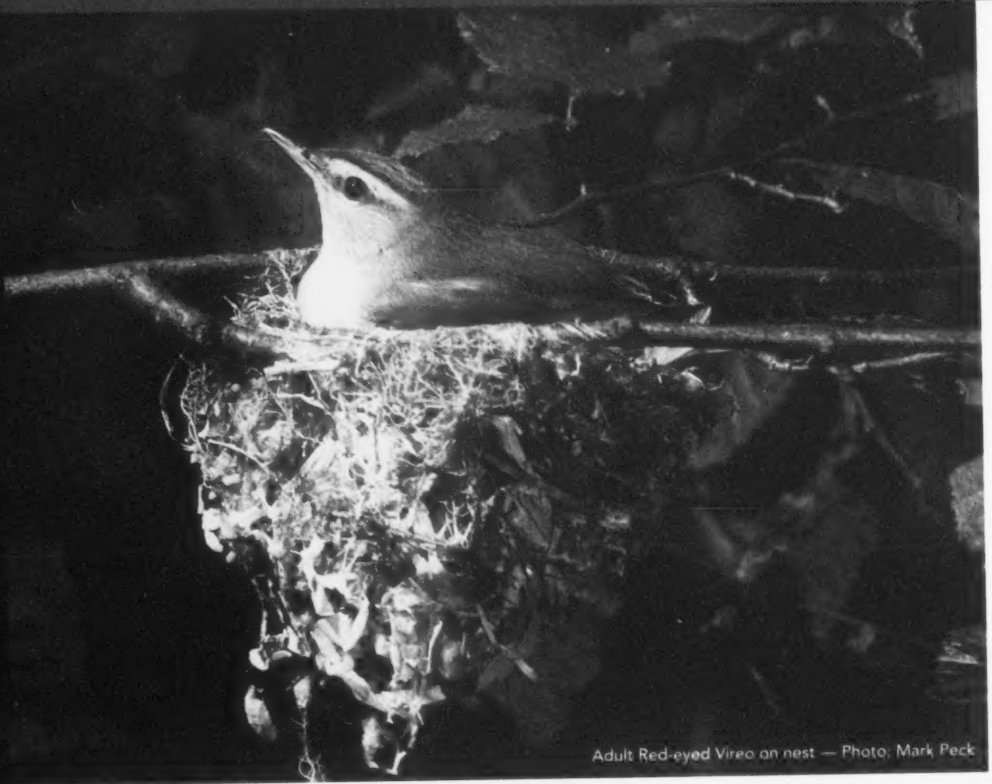
Identification (17–21 centimetres)

The Great Crested Flycatcher is a treetop species of deciduous forests and suburban areas that is easier to hear than to see. It is the largest and most brightly coloured flycatcher in eastern North America, having a bright yellow belly and cinnamon-rufous wings and tail. It has an olive back, grey breast and throat, pale edging on its wings, and a visible crest. The sexes are similar.

Did you know?

- **The Great Crested Flycatcher snaps its bill loudly and rapidly when agitated.**
- **This species only flies from place to place. It never walks or hops.**
- **In very deep cavities, the female may add nesting material that is more than a metre deep so that the nest is no farther than 30 centimetres from the cavity entrance.**

Red-eyed Vireo *Vireo olivaceus*



Adult Red-eyed Vireo on nest — Photo: Mark Peck

Identification (12–13 centimetres)
One of the most common birds of deciduous and mixed woodlands of eastern North America, the Red-eyed Vireo is most noted for its relentless, monotonous song, rather than its red eye (which only occurs in adults). It is yellow-green above and white below. It has a pale eyebrow, dark eyeline, and grey cap bordered by dark stripes. Its legs, wings, and thick, hooked bill are grey. The sexes are identical.

Conservation Status
The Red-eyed Vireo is an abundant and widespread species, occurring wherever an understorey of shrubs and saplings exist, in all but conifer dominated stands. Surveys indicate a range-wide population increase of 1.2 percent annually since 1968, with the Ontario population alone estimated to be nine million birds. However, this species is also sensitive to forest fragmentation and cowbird parasitism, so its populations bear monitoring.

Breeding Biology
The Red-eyed Vireo breeds from the Northwest Territories across all of Canada, south through all of the northern, central, and eastern US states. It breeds in Ontario from early May through July, raising one brood. Vireos build a unique basket-like nest covered in tree bark, and suspended by its rim to the fork of a small branch of a tree or shrub. Nests range from one to 19 metres above ground and are covered by foliage from above but open to the ground below. Females typically lay three to four whitish eggs, speckled with brown.

Diet
Red-eyed Vireos consume insects, caterpillars in particular. They also eat various small fruits in late summer. They forage by picking insects from leaves and twigs mainly in the canopy and subcanopy.

Management Guidelines
Populations are tolerant of small canopy openings created by thinning, group, and single-tree selection, though densities may decline if canopy is decreased more than 30 percent. They are considered to be a forest-interior species, yet Red-eyed Vireos will visit fragments as small as 0.5 hectares. Since their presence and productivity are related to forest size, and because they remain a frequent cowbird host, vireos benefit from practices that reduce fragmentation and edge creation.

How to Find
The repetitive whistled "here-I-am, where-are-you" song of the Red-eyed Vireo easily gives its presence away. Watch for it foraging deliberately along the outer periphery of tree branches within the canopy or subcanopy.

Did you know?

- The male Red-eyed Vireo can sing more than 20,000 times a day.
- During courtship, the male performs a swaying display, standing in front of the female and swaying its upper body and head from side to side.
- Upon finding an unwanted cowbird egg in the nest, the female will sometimes bury the egg with more nesting material and lay her clutch on top of it.
- Vireos will often scold and attack Blue Jays and other predators when close to their nest.

Blue Jay *Cyanocitta cristata*

Adult Blue Jay with nestlings — Photo: F. Truslow/VIREO

Identification (25–30 centimetres)

Although often disliked because it can be aggressive toward other birds, the boldly patterned Blue Jay is familiar to most people. Its bright blue plumage and loud "JAY JAY" call are unmistakeable. This medium-sized bird is blue above with its wings and tail boldly marked with black bars and white tips. It has a large crest, a white face, breast, and belly, and a long black bill. The Blue Jay has a black collar across its upper chest, extending up the sides of its neck to the rear of its face and connecting to a black eyeline. The sexes are identical.

Conservation Status

The Blue Jay is a common breeder in southern Ontario where it is found throughout most of the Carolinian and Great Lakes regions. It is least abundant in the intensive agricultural areas of the Carolinian zone in southwestern Ontario. Although its status in Ontario appears to be quite secure, the North American population as a whole has experienced slight yet significant declines of 1.1 percent annually (particularly in the eastern U.S.) since 1966.

Breeding Biology

The Blue Jay breeds from southern Canada through the eastern United States south to the Gulf Coast. Although part of its population migrates to more southerly portions of its range each year, many birds remain in Ontario throughout the year. Breeding habitat includes deciduous, coniferous, mixed forests, and treed urban areas (particularly those with mast bearing trees). In Ontario, jays breed from mid-May to late-July, lay four to six eggs that are whitish to greenish and marked with brown spots, and raise one brood per season. Blue Jays build a medium-sized cup nest of twigs and grasses, about 10 to 25 metres above the ground on a branch or crotch of a deciduous or coniferous tree.

Diet

The Blue Jay is an omnivore and eats arthropods, acorns and other nuts, fruits, seeds, and small vertebrates. It forages by gleaning food from trees, shrubs, and the ground, and sometimes catches insects in flight. Outside the breeding season, hard mast (particularly acorns) makes up the majority of its diet throughout much of the rest of the year.

Management Guidelines

Although the Blue Jay is highly adaptable and able to breed in urban areas, it occurs in much lower abundance in areas of intensive agriculture and low forest cover. Management practices that maintain forest cover and connectivity between woodlots are beneficial to this species.

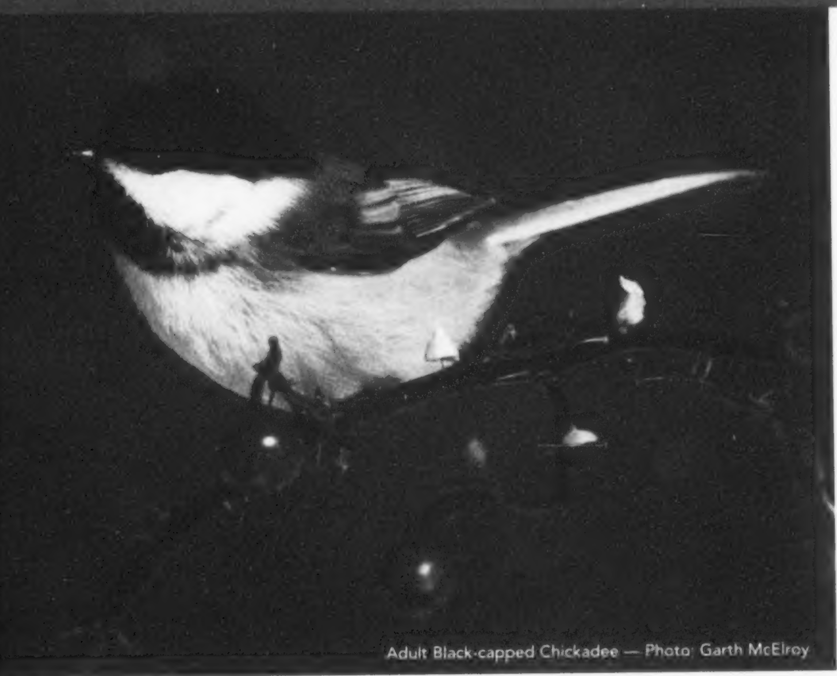
How to find

As a common resident throughout the year, the best opportunity to see a Blue Jay is at your bird feeder. Listen for their loud harsh "Jay Jay" calls.

Did you know?

- Some people dislike the Blue Jay because it is known to eat the eggs and nestlings of other birds.
- Migration patterns of Blue Jays are not predictable. Some individual jays may migrate south in one year, stay north the next winter, and then migrate south again the next year.
- The Blue Jay can make a variety of sounds and is known to frequently mimic the call of the Red-shouldered Hawk.
- Unlike most birds, mated pairs do not aggressively defend their breeding territories but may defend the nest if an intruder gets too close.

Black-capped Chickadee *Poecile atricapillus*



Adult Black-capped Chickadee — Photo: Garth McElroy

Identification (12–15 centimetres)

One of the most familiar and beloved birds in North America, the Black-capped Chickadee is a cheerful, inquisitive, sometimes tame species that often frequents bird feeders during the winter months. It is a permanent resident across its range, often congregating in flocks in winter. Both sexes have a black cap and bib, white cheeks, grayish back, and buffy sides.

Conservation Status

Black-capped Chickadees are widespread and common, with a stable or increasing (particularly in the eastern part of its range) population. They have benefited from human-provided food and nest boxes. Though habitat selection is variable, occurring in both small and large forests, chickadees are more common at forest edges.

Breeding Biology

The species ranges from coast to coast, including much of Canada and the northern two thirds of the United States. They require cavities for nesting and roosting but will utilize trees in many habitats from suburban areas, to deciduous and mixed-wood forests. Black-capped Chickadees are weak excavators, requiring wood in advanced decay, such as rotten snags or decayed branches in live trees. Nests are typically built in small-diameter, dead trees close to the ground. They also use natural cavities, old woodpecker cavities, and small bird boxes. In Ontario, chickadees breed from early-May to early-July, lay six white eggs marked with fine dots or spots of reddish brown, and typically raise a single brood, though second broods are not uncommon.

Diet

During the breeding season, Black-capped Chickadees feed primarily on small caterpillars, but also eat spiders, snails, slugs, centipedes, and some berries. Their diet in the winter is half insects and spiders, and half seeds and berries. They are frequently seen gleaning insects from foliage and tree bark, often hanging upside down to do so.

Management Guidelines

Black-capped Chickadees are quite tolerant of most forest management disturbances. It appears that little specific management needs to be directed towards this species, though the practice of "cleaning up the dead wood" is not recommended as it will eliminate all the small, decayed, snags and reduce local breeding densities.

How to find

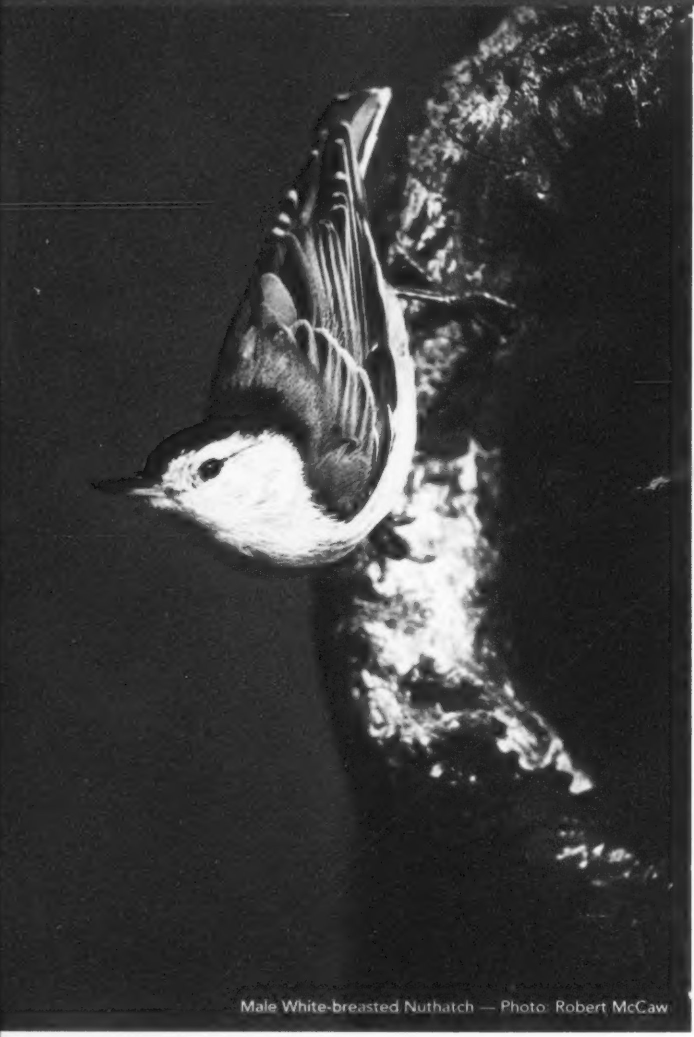
Black-capped Chickadees can be easily spotted at backyard bird feeders and in flocks during winter months. Sometimes holding out a handful of sunflower seeds is all that is required to bring a chickadee right to your hand! In the forest, listen for the familiar "chickadee dee dee dee" call note.

Photo: Peter Burke

Did you know?

- **Black-capped Chickadees exist within a rigid social hierarchy. Males are dominant to females, and adults are dominant to juveniles. Birds of higher ranking have access to the best food and nesting sites, and experience higher survivorship.**
- **Black-capped Chickadees store a large amount of seeds and other food in bark crevices for consumption in the winter. They have exceptional spatial memory and can relocate food caches up to a month after being stored.**
- **Black-capped Chickadees conserve energy during cold winter nights by entering a regulated state of hypothermia and lowering their body temperature.**

White-breasted Nuthatch *Sitta carolinensis*



Male White-breasted Nuthatch — Photo: Robert McCaw

Identification (13–14 centimetres)

The White-breasted Nuthatch is a small, common resident of deciduous forests and wooded suburbs that characteristically walks head first down large branches and trunks, probing crevices in bark for seeds and insects. It is grey above and white below, with a white face, long slightly-upturned bill, and a rufous patch under the tail. Males have black caps while female caps are dark grey.

Conservation Status

The White-breasted Nuthatch is common, widespread, and increasing throughout its range (two percent annually). In Ontario, it is most abundant in the south, where mature beech-maple forests are most widespread. Densities are lower and more localized in the highly fragmented Carolinian zone due to less habitat availability.

Breeding Biology

The White-breasted Nuthatch is a permanent resident from southern Canada to central Mexico. It generally inhabits edges or openings in mature deciduous woodland, but also uses mixed forest, and occasionally residential areas. Nests are most frequently built in a natural cavity of a large diameter tree, but nuthatches will also use abandoned woodpecker cavities and sometimes even nest boxes. Cavities are lined with fur, fine grass, and shredded bark. In Ontario, birds breed from late April to late June, laying six whitish eggs with brown speckling, and raising one brood per season. Unlike most species, they do not attempt to re-nest if their first nest fails.

Diet

The White-breasted Nuthatch eats insects, seeds, and nuts. It forages predominantly by moving up and down tree trunks and branches inspecting cracks and crevices for food. It will also forage on the ground in search of mast, visit feeders in the winter, and cache foods in bark crevices. The nuthatch is known for its habit of placing a hard seed in a bark crevice and then "hatching" it open by hammering it with his bill.

Management Guidelines

Careful single-tree selection prescriptions that maintain older-growth features (large, old trees with natural cavities and old woodpecker holes) will provide for nuthatches. Provisioning of habitat should be geared towards large forests, since survivorship of this species is reduced in small woodlots due to high exposure in the winter. Areas of uncut woodlands can also be used to increase the amount of older-growth habitat available for nuthatches.

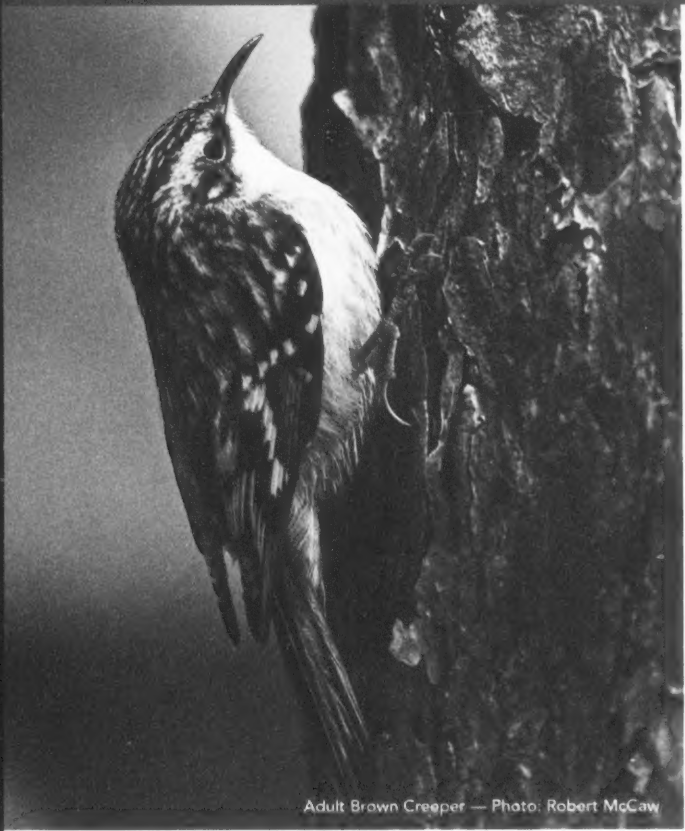
How to Find

Besides waiting for this common bird to visit your winter bird-feeders, listen for its nasal and slightly trilled sounding "yenk yenk" call in your woodlot in early May and June. Look for this attractive resident moving down the tree trunk head first.

Did you know?

- The White-breasted Nuthatch is territorial and maintains its pair bond throughout the year. Pairs remain together in the vicinity of the breeding territory during winter.
- In winter, the White-breasted Nuthatch joins mixed-species foraging flocks led by chickadees. Birds within these mixed flocks are believed to gain protection from predators by the combined vigilance of the other birds.
- An adult nuthatch will perform a distraction display when a predator closely approaches a nest by spreading its wings and swaying back and forth, while remaining in a fixed position.

Brown Creeper *Certhia americana*



Adult Brown Creeper — Photo: Robert McCaw

Identification (11–13 centimetres)

Although the Brown Creeper is distinctive in habit and appearance, it is small, well camouflaged, and has very high-pitched vocalizations, making it inconspicuous. It is brown, streaked with white and buff above and white below, with a long, thin, rufous tail, and a long, thin downward curving bill. Sexes are identical. Creepers characteristically spiral up tree trunks in search of food.

Conservation Status

The Brown Creeper is considered globally abundant and widespread, despite declines since presettlement times, due to the loss of large tracts of mature and old-growth forest. This species is uncommon in highly fragmented landscapes, and often declines in selectively managed forests. Accurate population estimates may be difficult to obtain due to their inconspicuous behaviour and vocalizations, and low breeding densities in southern Ontario.

Breeding Biology

The Brown Creeper breeds in mature forests, especially conifers, in Canada, Alaska, and the northeastern and western United States. They are permanent residents through much of their range, though the majority of northern birds migrate south to the United States. Creepers build unusual nests under a loose piece of bark or in a tree crevice, composed of roots, grass, moss, and conifer needles held together with spider silk. In Ontario, they breed from late April to early July, lay five or six white eggs, often with sparse brown speckling, and raise a single brood.

Diet

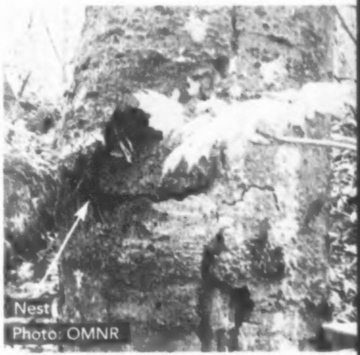
Creepers feed mainly on small invertebrates in the furrows and cracks of the bark. The Brown Creeper often hitches up the bole of a tree, circling the tree as it climbs, then flies down to the base of another tree to start the search all over again. Its winter diet is supplemented with seeds.

Management Guidelines

Although the Brown Creeper is found in a variety of forest habitats, its security is uncertain because of its preference for mature, closed canopy forest with numerous dead or dying trees for nesting and large live trees for foraging. It is also a forest interior bird sensitive to fragmentation. Silviculture practices that retain a high density of large snags and live trees (>50 cm dbh), extend harvest cycles, and reduce edge effects and fragmentation will support creeper populations.

How to Find

Their relatively low densities, thin high pitched song and calls, and excellent camouflage make Brown Creepers difficult to find. Nonetheless, listen for their song, and look on large tree trunks to catch a glimpse of this small bird creeping up the side of a tree.



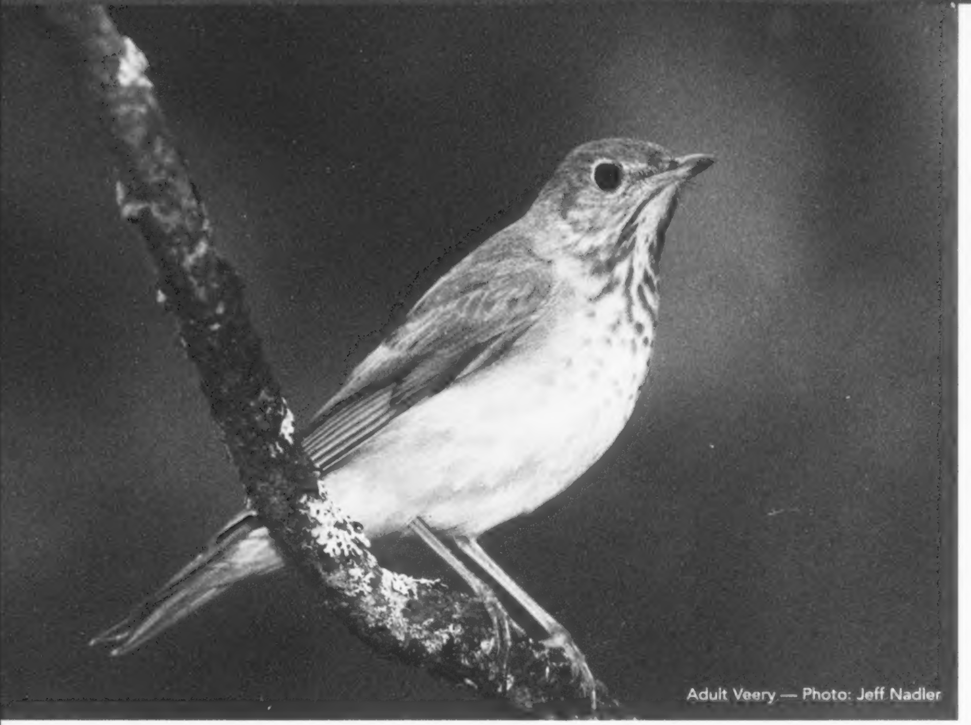
Nest

Photo: OMNR

Did you know?

- The female Brown Creeper may take up to 30 days to build her nest.
- In the presence of a potential predator, the Brown Creeper will "freeze" with its body pressed flat against a tree trunk in order to camouflage itself.
- The creeper has stiff tail feathers, short legs, and long toes that allow it to easily "creep" up the sides of tree trunks.
- Their nests often have two openings, one that serves as an entrance and the other as an exit.
- A group of creepers is collectively known as a "sleeze" or a "spiral" of creepers.

Veery *Catharus fuscescens*



Adult Veery — Photo: Jeff Nadler

Identification (17–18 centimetres)

A shy tawny thrush of damp deciduous and mixed forests, the Veery spends much of its time on the forest floor. Both sexes are uniformly reddish brown above, pale below, with indistinct reddish brown spots on the throat and breast. It is distinguished from other thrushes by a weak eye-ring and lack of distinct spotting along the belly and sides.

Conservation Status

Veery populations have suffered annual declines averaging 1.5 percent across its range since the mid 1960s. Despite these losses, it remains a common bird in Ontario, where its population is estimated to consist of about two million birds. While the Veery is clearly still common in Ontario, populations of this area-sensitive species are sparse in the fragmented southwest where preferred habitat is a limiting feature.

Breeding Biology

The Veery breeds across the southern third of Canada and the northern United States, into the Appalachian and Rocky Mountains. It breeds in young second growth damp deciduous and mixed forest in areas of dense understorey. Veeries build a bulky nest of leaves, stems, bark strips, mud, and roots, on or near the ground at the base of a shrub or tree, or atop a rotting stump. In Ontario, they breed between mid-May and mid-July, laying four blue eggs, and raising one brood per season.

Diet

During the breeding season, Veeries forage for insects, mostly on the ground, and to a lesser extent in the foliage. In late summer and fall, their diet largely shifts to berries. Food includes adult beetles, snails, caterpillars, spiders, centipedes, ants, wasps, small frogs, salamanders, raspberries, elderberries, and dogwood berries.

Management Guidelines

Although breeding habitat for the Veery does not appear to be limiting in many regions, practices that create early to mid-successional habitats, particularly single tree selection, are beneficial. Efforts should be made to reduce edge effects, since this species is sensitive to nest parasitism by Brown-headed Cowbirds. Increased browsing of understorey by growing populations of white-tailed deer is likely a problem for nesting Veeries in many areas, but this remains undocumented.

How to Find

The Veery is a rather secretive and cryptic bird that can make it difficult to spot. Listen in moist woodlands for its distinctive ethereal, and downward spiraling flute-like "vee-ur, vee-ur, veer, veer" song that resonates as if singing into a metal pipe. See page 27 for a photo of a Veery nestling.

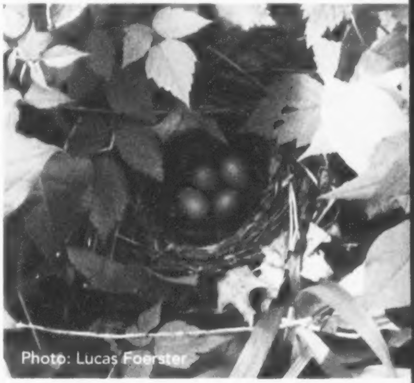
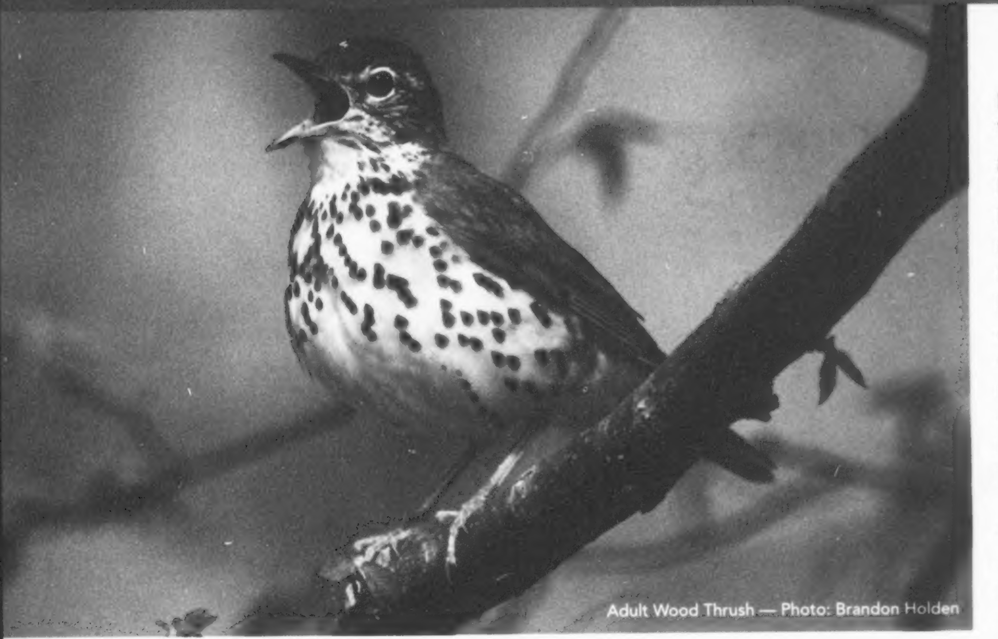


Photo: Lucas Foerster

Did you know?

- Where the Veery's range overlaps with the Wood and Hermit thrush, the Veery chooses forest habitats that are younger and wetter.
- Loss of habitat on the wintering grounds is of concern for the future of the Veery.
- Its wintering range is narrow, and is largely restricted to western Brazil, Venezuela, and eastern Columbia.

Wood Thrush *Hylocichla mustelina*



Adult Wood Thrush — Photo: Brandon Holden

Identification (19–21 centimetres)

The Wood Thrush has become one of the icons of declining Neotropical migrant songbirds. Its trademark, ethereal, flutelike "ee-oh-lay" song is a familiar sound in forests of the eastern United States and southeastern Canada. It is similar to other thrushes, but has a bold white eye-ring and large black spots on its white belly that contrasts with its rusty head and duller brown back. The sexes are similar in this robin-sized bird.

Conservation Status

Even though it is still one of the most common species inhabiting eastern forests, the Wood Thrush is of high conservation concern because of steady, long-term population declines throughout much of its range. It has declined by about 50 percent overall since 1968, and faces continued habitat degradation and destruction on both its breeding and Central American wintering grounds. Increased fragmentation on the breeding grounds results in higher rates of nest predation and cowbird parasitism, decreasing reproductive success. As such, sustainability seems to hinge on large tracts of mature forest.

Breeding Biology

The Wood Thrush breeds from early May to the end of July in the interior and edges of deciduous and mixed forests, often near water. It needs moderate to dense understorey, shade, moist soil, and decaying leaf litter. The nest has a base of dead leaves, to which is added a mixture of grasses, mud, and rootlets. Nests are typically situated two to four metres above the ground in a fork or on a horizontal limb of a shrub or tree. Females lay clutches of three or four blue eggs, and can raise two broods per season.

Diet

Wood Thrushes forage by gleaning and probing in the leaf litter on the forest floor. They hop a few times and then pause to scatter dead leaves with their feet, in search of invertebrates like beetles, flies, ants, caterpillars, and millipedes, which make up the majority of their diet. They also consume various types of berries during late summer once these fruits have ripened.

Management Guidelines

Although the Wood Thrush will breed in small forest fragments, reproductive success is compromised. Single-tree selection is a superior method to diameter-limit harvests or uncut upland stands, because it creates favourable micro-habitat conditions for the species five to10 years post-harvest. Though densities decline immediately after harvest, high nest success and low parasitism rates occur in older selection stands.

How to Find

Typically, the yodelled "ee-oh-lay" song alerts visitors to its presence. You may spot one singing in the mid-storey from an exposed perch, or flush a bird from the forest floor. Also, watch for leaves being tossed around, or listen for the sound of rustling leaves to find a Wood Thrush on the ground.

Photo: Peter Burk

Did you know?

- The specialized voice box (called the "syrinx" in birds) of the Wood Thrush allows it to sing two notes at once. Essentially, it can sing in harmony with itself!
- They often flick their wings to communicate with other Wood Thrushes.
- A Wood Thrush often returns to the same breeding territory in successive years. It also may return to the same wintering area each year.
- Wood Thrush pairs with fledged young are known to divide the brood amongst themselves, with each parent caring for a particular group of young.

American Robin *Turdus migratorius*

Male American Robin — Photo: Garth

Identification (20–28 centimetres)

The American Robin is perhaps the most familiar bird in North America. Known by many as the harbinger of spring, it is often seen hopping across lawns in search of food. The robin is best characterized by its brick-red breast. It has a white throat and white crescent around the eye, and a relatively thin yellow bill. The male is usually a little brighter than the female and has a blacker head. Though robins are commonly associated with backyard lawns and parks, this species is very adaptable and occurs in a variety of habitats, including large forests.

Conservation Status

The American Robin is the most abundant and most widespread thrush in North America, and has a stable or increasing population. Unlike many species, this highly adaptable bird has benefited from suburbanization and widespread forest loss and fragmentation. However, robins are sensitive to pesticides (due to high intake of earthworms) and populations are susceptible to die-offs or reduced nest success due to chemical pollution.

Breeding Biology

The American Robin breeds from Alaska and northern Canada southward to northern Florida and Mexico. Although it's at home breeding in deep, mature forests, the robin is tolerant of human-modified habitats. It will breed in parks, backyards, gardens, orchards, riparian zones, and deciduous, mixed or coniferous forest edges and interiors. The female builds a nest of grass and mud, saddled on a branch of a tree or shrub, or on a flat man-made structure. They are prolific breeders, typically laying four blue eggs, and raising two or three broods per season.

Diet

The American Robin is omnivorous, feeding mainly on a wide variety of invertebrates during the breeding season and on fruit in the fall. The robin gleans vegetation in search of food on the ground, in trees, or shrubs. Earthworms, snails, moths, and many kinds of fruit (including juniper, hawthorn, chokecherry, wild grape, honeysuckle, and dogwood) are commonly eaten.

Management Guidelines

Since the American Robin often occurs in open areas interspersed with trees and shrubs, forestry practices that create early successional habitats can be beneficial for this species. None of the currently recommended silviculture practices for existing woodlands have been shown to be detrimental to breeding robins.

Photo: OMNR

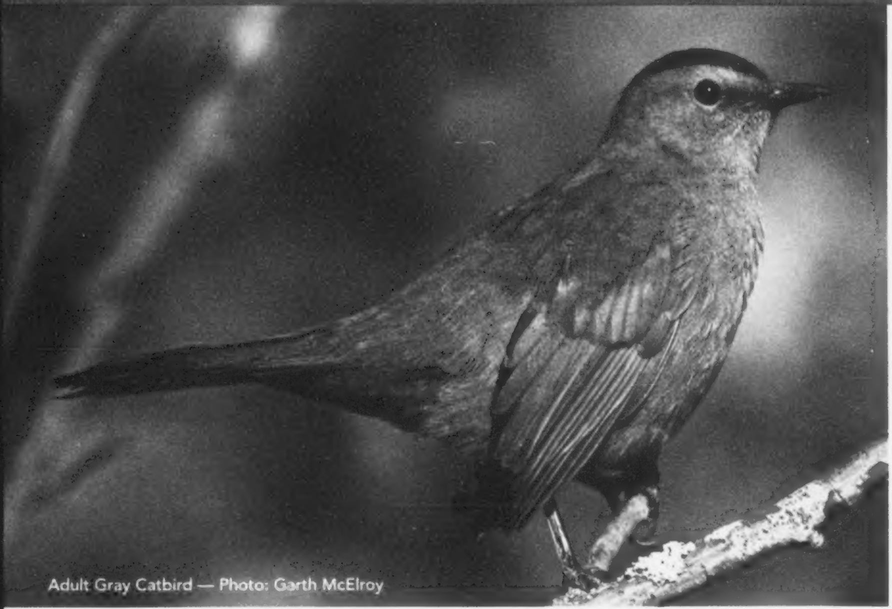
How to Find

If you want to see an American Robin all you have to do is scan your lawn in the spring or summer and you will likely spot one foraging for worms. It's that simple!

Did you know?

- Having evolved together, American Robins easily recognize and remove Brown-headed Cowbird eggs.
- Although the appearance of a robin typically heralds the arrival of spring, they are short-distance migrants and many of them actually spend the winter in southern Ontario. The number of robins wintering in Ontario varies each year with local weather conditions. However, because they congregate in large flocks during winter, and spend less time in backyards, you're much less likely to see them.

Gray Catbird *Dumetella carolinensis*



Adult Gray Catbird — Photo: Garth McElroy

Identification (21–24 centimetres)
Heard more than seen, the Gray Catbird is a secretive, but curious skulker of dense thickets. Its rambling song includes imitations of other birds, but the characteristic "mew" call note is reminiscent of a cat. It is a grey medium-sized bird with rufous undertail feathers, and a black cap and tail. The sexes are identical.

Conservation Status
The Gray Catbird is widespread and common in early successional forest habitats across southern Canada and south through most of the United States, except the dry Southwest. Its continental population is essentially stable, though there has been a slight decline of 1.6 percent annually in Ontario since 1966. This species has benefited from human activity, and is very common in dense tangles associated with openings and edges in southern Ontario.

Breeding Biology
Catbirds select shrub-sapling stage successional habitats, nesting in dense shrubs or vine tangles. Breeding occurs between early May and mid-August in Ontario. The female builds a bulky nest of grasses, twigs, leaves, rootlets, and bark strips, lays three or four blue eggs, and can raise two broods per year.

Diet
The Gray Catbird is an opportunistic feeder, foraging from the ground up to the canopy, but primarily at low heights. It will search through leaf litter, glean insects from bark and leaves, hover or hop on branches, catch insects in flight, and pick fruit and flowers off trees and shrubs. Its diet includes ants, moths, flies, dragonflies, spiders, caterpillars, grasshoppers, beetles, and a wide variety of fruits (e.g., raspberries, grapes, cherries). Its diet shifts from 80 percent insect in the spring to 80 percent fruit in the fall and winter.

Management Guidelines
The Gray Catbird benefits from activities that maintain or create early successional habitat usually associated with even-aged systems or group selection. This includes isolated patches within forests, regenerating cutovers, forest edges, fencerows, and suburban areas.

How to Find
Because the Gray Catbird spends much of its time in dense shrubby areas, it can be difficult to spot. However, it is a loud and persistent songster. Listen for its hodgepodge of rambling, warbling sounds interspersed with its cat-like mew to find this low lying skulker.

Photo: OMNR

Did you know?

- The Gray Catbird is one of the few species that has learned to recognize and eject cowbird eggs. However, this learning can go awry if a cowbird lays an egg in the nest before the female catbird does. In such cases, the female may eject her own eggs as they are laid.
- Its Latin name reveals that it is associated with shrubby habitats (*Dumetella* means "small thicket") and that it primarily occurs in the Carolinian zone (*carolinensis*).

Blue-winged Warbler *Vermivora cyanoptera*

Female (left) and Male (right) Blue-winged Warblers with nestlings — Photo: B. Henry/VIREO

Identification (11–12 centimetres)
The Blue-winged Warbler is easily overlooked skulking in thick undergrowth, despite its bright colour. Males are unmistakable — yellow above and below, grey wings with two white bars, and a black eye stripe. They sing a two-syllable insect-like "beeeee-buzzzzzz." Females are duller, but otherwise similar.

Conservation Status
The Blue-winged Warbler breeds in open scrubby areas in southern Ontario and the eastern U.S. Its population in Ontario has increased over the last few decades due to a northeast expansion in breeding range, where it is replacing the very closely-related Golden-winged Warbler. However, across its entire North American breeding range, numbers have decreased 1.1 percent annually due to forest maturation and urban sprawl.

Breeding Biology
The breeding range of the Blue-winged Warbler has changed markedly over the last century. It breeds in early to mid-succession habitats, especially abandoned farmland and forest clearings, and at forest/field edges, often shaded by large trees. It breeds from late-May to end of June, seeking out openings with dense understorey. It builds a well concealed nest of grasses, bark and dead leaves on or near the ground. The female lays four or five eggs that are white with brown speckling, and raises a single brood.

Diet
Blue-Wings eat insects and spiders, particularly caterpillars, grasshoppers, and crickets. They forage in the upper half of trees and shrubs, often hanging upside down while probing for insects in curled leaves, buds, flowers, or on twig surfaces.

Management Guidelines
Although not currently a species of concern in Ontario, significant declines have occurred across much of their range in the United States. Blue-winged Warblers benefit from management strategies that maintain early to mid-successional habitats, including prescribed burns in fire-dependent habitats.

How to Find
This species can be found in areas of dense shrubs along forest edges. Listen for its loud insect-like "bee-buzzzz" song or watch for its chickadee-like behaviour probing in leaves in the lower canopy.

Did you know?

- The Blue-winged Warbler hybridizes with the Golden-winged and typically displaces them in areas of territory overlap and hybridization, often within 20 years of initial contact.
- Expansion of Blue-wings is linked to declines in populations of Golden-wings, since they are more of a habitat generalist and are genetically dominant.
- As soon as nest construction begins, the female Blue-winged Warbler will sit on the nest every night even though it is incomplete and has no eggs in it yet.
- Leaves can be positioned over nests to form a cap that conceals eggs and brooding females.

Golden-winged Warbler *Vermivora chrysoptera*

Male Golden-winged Warbler — Photo: Jeff Nadler

Identification (13 centimetres)

The Golden-winged Warbler is a small grey bird of open scrubby areas. Its wings and crown are marked with bright yellow patches. Both sexes have a white eyebrow and mustache. The male has a black mask and throat which is dark grey in females.

Conservation Status

The Golden-winged Warbler has generated a great deal of scientific and public interest over the last several decades as one of the fastest declining songbirds in North America. Declines stem from the loss of early successional scrub habitat, hybridization with the closely related Blue-winged Warbler in areas where the two species' ranges overlap, and loss of habitat on its restricted wintering grounds in South America. At the same time, its breeding range has been expanding to the north where pastureland abandonment is common. In Canada, the species is listed as threatened.

Breeding Biology

The Golden-winged Warbler's breeding range is concentrated in the northeastern United States, southern Ontario, and southern Manitoba, with scattered populations in southwestern Quebec and extreme southeast Saskatchewan. In Ontario, it breeds from mid-May to mid-July in early successional deciduous habitats such as forest edges, shrubby power-line corridors, abandoned farm fields, and second growth forest with sapling regeneration, typically surrounded by mature forests. Nests are constructed on the ground or slightly above, often placed at the base of a plant or in a grass tussock. The female lays four to five whitish eggs with brownish speckling, and raises one brood per season.

Diet

Moths, including larvae and pupae, are the main food of the Golden-winged Warbler. It also eats spiders and various winged insects. It forages at various levels, often hanging upside down from branches, and probing curled leaves in search of prey.

Management Guidelines

The Golden-winged Warbler suffers from a loss of nesting habitat due to succession, urban sprawl, and large scale reforestation. Management that maintains early successional forest habitat is crucial for its survival. Because of the ephemeral nature of its habitat, it is important to have areas that are recently disturbed or burned at a local scale to maintain habitat for this early successional forest specialist.

How to Find

Search for the Golden-winged Warbler in dense shrubby areas near forest edges. Make sure to listen for its descending buzzy call — "bee-buzz-buzz-buzz."

Photo: Greg Lavaty

Did you know?

- The Golden-winged and Blue-winged Warbler hybridize to produce viable offspring. The Blue-wing has a dominant genetic makeup, so Golden-wings effectively become genetically "swamped."
- In areas of contact, Golden-wings may be replaced by Blue-wings in less than 10 years.
- Hybrids do not sing intermediate songs but sing either normal Blue-winged Warbler or Golden-winged Warbler songs. Some birds sing both. Occasionally pure-looking parental types sing the wrong song.
- Adult Golden-winged Warblers that have nestlings will attempt to lure away nearby predators by repeatedly carrying food to a fake nest location.

Chestnut-sided Warbler *Dendroica pensylvanica*

Female (left) and Male (right) Chestnut-sided Warbler — Photo: Mark Peck

Identification (10–11centimetres)

A bird of scrubby second-growth areas and forest edges, the Chestnut-sided Warbler is one of the few Neotropical migrants that has benefited considerably from human activities. This warbler is distinguished by its yellow cap and chestnut sides. It is white below with a black eye stripe and mustache. Females are duller, with less extensive chestnut on their sides.

Conservation Status

The range of the Chestnut-sided Warbler dramatically expanded in the early 1800s with the clearing of forests and increased availability of early-successional scrub habitat. Once a rarely observed species in Ontario, the Chestnut-sided Warbler is now one of our most common and widespread warblers. Despite some declines since the 1960s, this species appears to be maintaining healthy populations. In Ontario, densities are highest in the southern shield where second growth deciduous forest is abundant.

Breeding Biology

The Chestnut-sided Warbler breeds throughout much of eastern Canada, from central Saskatchewan east to Nova Scotia and south through the northeastern United States. Birds select shrubby, predominantly deciduous, early-successional habitats such as second-growth woodlands, edges, and regenerating fields, clearcuts, and small forest openings. Nests are located in a small crotch of a shrub, less than two metres from the ground, and consist of grass, stems, bark, and spider web. In Ontario, birds breed in late May to late July, lay four white eggs with brown speckling, and raise a single brood.

Diet

The Chestnut-sided Warbler gleans insects from the bottom of leaves. It forages at low levels in shrubs (often raspberry thickets) and eats caterpillars, fly larvae, spiders, other insects, and some berries.

Management Guidelines

Forest management practices that create openings where early-successional habitat regenerates, such as heavy partial harvest, will benefit the Chestnut-sided Warbler. This includes shelterwood, group selection, and diameter limits. It is absent from mature forests or recent clearcuts, where shrubby, edge habitat is absent.

How to Find

The Chestnut-sided Warbler can typically be found low in shrubby forest patches and forest edges. Be sure to listen for its loud, emphatic "pleased-to- MEETCHA" song.

Did you know?

- The Chestnut-sided Warbler has two basic song types. The first includes simple songs with accented endings ("pleased pleased pleased-to-MEETCHA"). This song appears to attract or keep in contact with females. The other song type involves more complex songs with unaccented endings. These are used mainly in territory defense against other males. Males that sing only unaccented songs are less successful at securing mates than males that sing both songs.
- Chestnut-sided Warblers join mixed flocks with local tropical birds on their wintering grounds in Central America. These flocks appear to consist of the same individuals from one year to the next.

Cerulean Warbler *Dendroica cerulea*

Female Cerulean Warbler — Photo: Greg Lavaty

Identification (11.5 centimetres)

The Cerulean Warbler breeds in mature, deciduous forests in association with tall, large diameter trees. Males are sky blue above and white below with a thin blue-black necklace and dark streaked sides. Females are drab blue-green above, whitish below with a pale yellowish eyebrow. Both sexes have two prominent white wing bars and white tail spots.

Conservation Status

This area-sensitive species is of great conservation concern because of its small range and population size. It has declined an alarming 70 percent throughout its range since 1966 (four percent per year), due to loss and fragmentation of mature forest habitat, and loss of appropriate vegetation structure and composition. The Cerulean Warbler is listed as a species of Special Concern in Canada and the United States.

Breeding Biology

The Cerulean Warbler's breeding range extends from the central-east United States north to southern Ontario and extreme southern Quebec. It has a very patchy distribution within this range, breeding in uplands or wet bottomlands in mature or old-growth deciduous forest. Ceruleans have specific preferences for large, tall trees, open understorey, and a structurally diverse canopy with multiple vegetation layers. They typically build shallow woven cup nests, far out on a horizontal branch in the upper canopy. Females lay four grayish, greenish, or creamy-white eggs that are spotted or blotched with reddish and greyish brown. Only one brood is raised per season.

Diet

The Cerulean Warbler is insectivorous, typically foraging high in the canopy, hopping along small branches gleaning insects from leaves and twigs. Its diet is comprised mainly of caterpillars, spiders, bees, wasps, and weevils.

Management Guidelines

The Cerulean Warbler has become a symbol of healthy, mature deciduous forests. It is rather intolerant of intensive habitat disturbances, but does breed successfully in sites managed for maple syrup, and will tolerate selection and shelterwood harvests. Ceruleans benefit from the protection of old-growth or wilderness areas and management efforts that focus on the production of high quality timber, because they rely on tall, large diameter, full canopy trees. These practices allow for longer rotations, uneven-aged structure, vertical diversity, and tall canopies, while high-grading, diameter-limit cuts and even-aged systems that remove most or all the largest trees are unsuitable. Carefully applied group selection cuts may be a good tool, since Ceruleans not only associate with small canopy gaps and internal openings, they select for mid-tolerant trees like oak and hickory.

How to Find

Slap on your hiking boots and grab a good pair of binoculars if you want to find this tiny forest interior bird that spends most of its time in the canopy of mature stands. Listen for its distinctive rapid high-pitched buzzy "zee zee zee zizizizi eeet" song that rises at the end.

Male Cerulean Warbler feeding nestlings — Photo: L. Walkinshaw/VIREO

Did you know?

- The Cerulean Warbler migrates farther and sooner than other warbler species, arriving at breeding grounds up to two weeks earlier and returning to wintering grounds as early as August.
- Over 60 percent of Cerulean wintering habitat in the South American Andes has been converted to crop land largely for sun-grown coffee and coca.
- The female Cerulean Warbler is known to drop vertically from the side of the nest with wings closed, only opening them when she is several metres below the nest, a behaviour known as bungee-dropping.
- When renesting after a failed nest, females often uses spider web from the old nest to start construction on the new nest. Fresh lining is gathered for the new nest, but spider web may be too valuable and time-consuming to waste.

Prothonotary Warbler *Protonotaria citrea*

Male Prothonotary Warbler — Photo: Greg Lavaty

Identification (14 centimetres)

Restricted to deciduous swamp forests, the Prothonotary Warbler is frequently billed as one of the North America's most beautiful songbirds. The adult male's head, throat and breast are brilliant golden yellow, contrasting with an olive-green back and bluish-grey wings and tails. It has no wing bars, but white spots on its outer tail feathers are quite prominent. Females are similar, but drabber in colour.

Conservation Status

The Prothonotary Warbler is one of Canada's most endangered birds, restricted to extreme southwestern Ontario, largely within 20 kilometres of Lake Erie. The core of the population occurs in the southeastern United States, northward up the Mississippi River valley. Its continental population has declined by about 40 percent since 1966, while that of Ontario has been reduced from 100 pairs, to no more than 10 to 20 pairs. Population declines are linked to loss and degradation of swamp forest habitat, coupled with fierce competition for cavity nest sites with House Wrens. Dramatic and escalating losses of coastal mangrove forest on its wintering grounds in Latin America is a serious conservation concern.

Breeding Biology

The Prothonotary Warbler's breeding range is restricted to eastern North America, from extreme southern Ontario south to Florida and west to western Texas. The only warbler in eastern North America that nests exclusively in tree cavities, it is incapable of excavating its own cavity. It relies either on naturally formed small and shallow cavities or on those created by chickadees. Nest sites are nearly always located over pools of water, one to three metres above the water surface. Nests are primarily composed of shredded chunks of green moss, with dead leaves mixed in, and lined with fine rootlets and grasses. In Ontario, birds breed from mid May through early July, lay four to six pale eggs that are speckled with browns and lavenders, and normally raise only one brood per year. See page 17 for a photo of a Prothonotary Warbler at a nest cavity.

Diet

The Prothonotary Warbler forages on branches and leaves from ground level to the upper canopy. Its summer diet consists of caterpillars, spiders and other small invertebrates.

Management Guidelines

As a specialized, secondary cavity-nesting species that builds its nest largely out of shade tolerant mosses, the Prothonotary Warbler is sensitive to all forms of forest management, including fuel wood cuts. Retention of large, mature swamp forests in an intact condition, particularly at sites that have a record of historical occupancy is recommended. Increasing the extent of swamp forest habitat in southern Ontario is expected to benefit this and numerous other species.

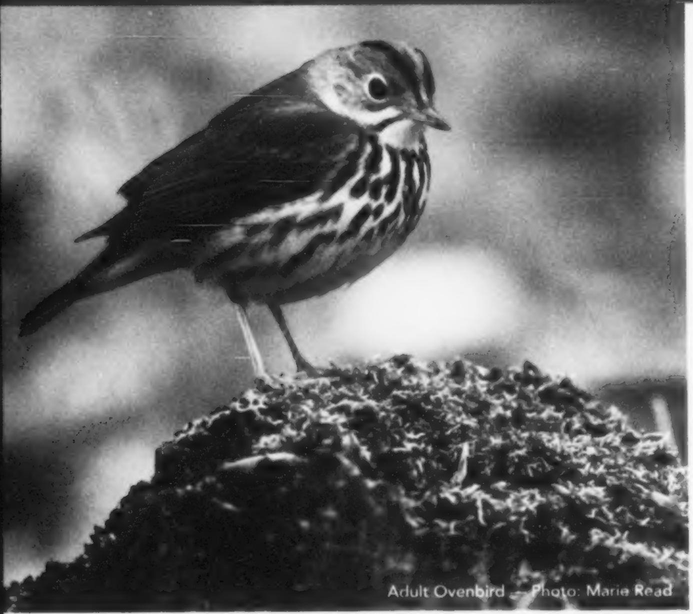
How to Find

Owing to its extreme rarity in Canada, it is unlikely that you'll encounter this species, except perhaps during migration at Point Pelee, Rondeau, or Long Point. Listen for the male's loud, ringing "tsweet-tsweet-tsweet" song in swamp forests and along wooded floodplains.

Did you know?

- **Male Prothonotary Warblers frequently build one or more partial nests (called dummy nests), perhaps as a way to attract prospecting females.**
- **Prothonotaries have been known to nest in some strange cavities, including old wasp nests, coffee cans, and mail boxes. They readily accept nest boxes, but this is only beneficial if there are no House Wrens in the area.**
- **On the wintering grounds, some Prothonotaries seem fond of feeding on oranges that have been split open by other animals. This often stains their foreheads in various shades of orange that persists through the following breeding season.**

Ovenbird *Seiurus aurocapilla*



Adult Ovenbird — Photo: Marie Read

Identification (11–14 centimetres)

A small, inconspicuous warbler of the forest floor, the Ovenbird is one of the most characteristic birds of the eastern forests. Though its loud song, *teacher, teacher, teacher,* rings through the summer forest, the bird itself is hard to see. Sexes are identical and have olive brown backs, white undersides with bold, dark streaked spots, white eye-rings, and orange crowns bordered by black stripes.

Conservation Status

The Ovenbird breeds in mature deciduous and mixed forests across northern and northeastern North America. It is widely distributed across Ontario, occurring in every treed region of the province. However, declines have been detected in the Carolinian region, where fragmentation of large forest blocks continues to result in habitat loss and degradation. In much of the extreme southwest, it is virtually absent because woodlots are very small and fragmented. Populations have remained stable in the southern Shield despite its sensitivity to logging and loss of mature forest habitat, because forest cover there remains high. Overall, the Ovenbird is an area-sensitive, mature forest specialist, and though it presently remains one of the most abundant forest bird in many regions, its sensitivity to widespread disturbance suggests continued declines in the future.

Breeding Biology

The Ovenbird is both a ground forager and nester, selecting breeding areas often deep in the forest where there is a closed canopy, open understorey, and deep leaf litter. Although the species' density tends to be higher where deciduous trees dominate, it has a broad tolerance for different tree communities. In Ontario, the Ovenbird breeds from mid-May through early July, raising one brood per season. They lay clutches of four to five eggs. Eggs are white, covered with rather large cinnamon-brown spots chiefly around the larger end. Nests are difficult to find, since females build cryptic, domed nests of dead leaves and grasses on the forest floor and are hesitant to flush. See page 20 for more photos of the almost invisible Ovenbird nest.

Diet

Ovenbirds feed primarily by walking slowly and continuously gathering invertebrates from the surface of the litter on the forest floor. They eat earthworms, insects, slugs, snails, and spiders, with beetles (adults and larvae), ants, and caterpillars being dominant food items.

Management Guidelines

Reduction of large, contiguous tracts of forest to smaller, isolated fragments has interfered with breeding and resulted in local population declines. As such, efforts should be made to conserve or expand large, mature forest tracts. Though densities often decline after forest harvesting, populations can rebound within as little as 30 years following partial cuts but may take much longer (60 to 100+ years) following clear cutting. Large interior forest areas that are left uncut will provide the best breeding habitat for Ovenbirds. Under the selection system, leaving large areas for 25 to 40 years between cuts will help maintain their habitat.

How to Find

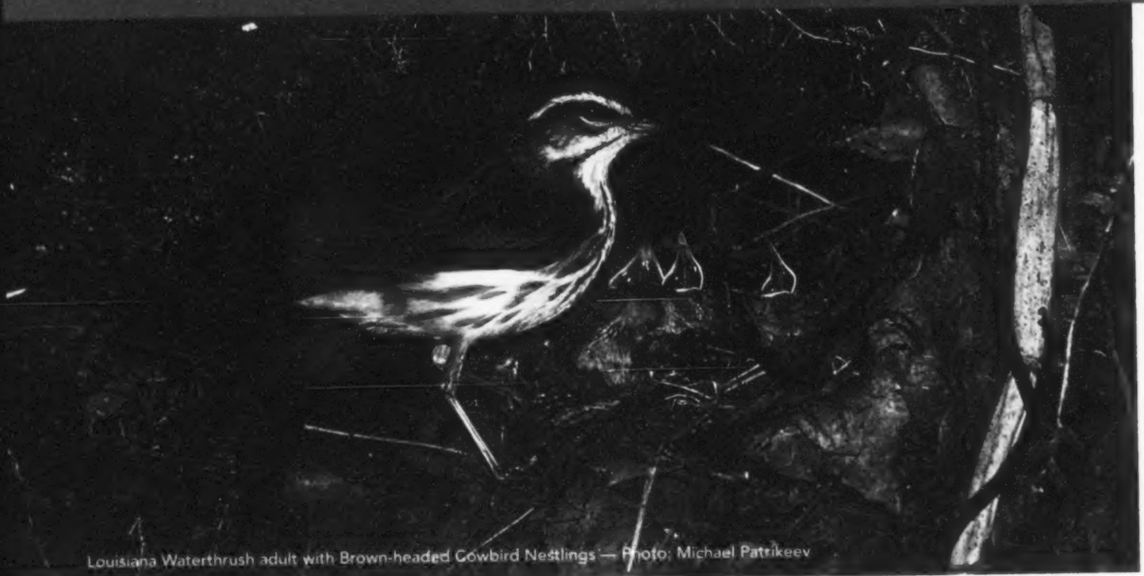
You can spot an Ovenbird by looking for singing males mid-canopy on an exposed branch of a deciduous tree. Listen for their loud resounding "teacher teacher teacher" song. Often, males will sing in response to a neighbouring male.

Photo: Lucie Foerster

Did you know?

- The Ovenbird gets its name from the Dutch oven type nests they build, with a unique, camouflaged covered top and a side entrance.
- Female Ovenbirds perform a crippled-wing display to distract predators when flushed from the nest. They look like a scurrying mouse.
- Male Ovenbirds that sing continuously, particularly late in June and July, are still hunting for a mate.

Louisiana Waterthrush *Parkesia motacilla*



Louisiana Waterthrush adult with Brown-headed Cowbird Nestlings — Photo: Michael Patrikeev

Identification (14 centimetres)

The Louisiana Waterthrush is a southern species found in steep, forested ravines with fast-flowing streams. Both sexes are brown above with prominent white eye stripes, white below, and have pink legs. Waterthrushes flick their tail in a bobbing motion when they walk. Despite being drab in appearance, this species sings a loud ringing song with clear whistles and complex jumbled phrases.

Conservation Status

The Louisiana Waterthrush is rare in Canada and is designated as a species of special concern. Populations have remained relatively stable across its range, with an estimated 105 to 195 pairs breeding in Ontario. It is common nowhere, and largely restricted to the Carolinian region in Elgin, Oxford, Middlesex, and Norfolk counties.

Breeding Biology

The Louisiana Waterthrush breeds from southeastern Minnesota eastward to southern Maine, and southward to eastern Texas and northern Florida. It prefers deep ravines and pristine headwater streams surrounded by mature deciduous/mixed forests (particularly where hemlock is present). In Ontario, birds breed from early May to early July, lay five white eggs with reddish-brown speckling, and raise a single brood. Nests are concealed in crevices along a stream bank, in upturned roots, or in and under mossy logs and stumps.

Diet

Louisiana Waterthrushes forage on and near the ground, picking at the substrate, pulling up submerged leaves, catching flying insects, and gleaning insects off vegetation. They feed mainly on aquatic invertebrates, but also eat other insects, arthropods, earthworms, and occasionally small frogs and fish.

Management Guidelines

The Louisiana Waterthrush is an area-sensitive species that requires large contiguous tracts of mature or late-successional forests with shady riparian or stream habitats. Given its rarity, care should be taken to retain high basal area, and refrain from logging activities that increase siltation and temperature of streams wherever this species is found.

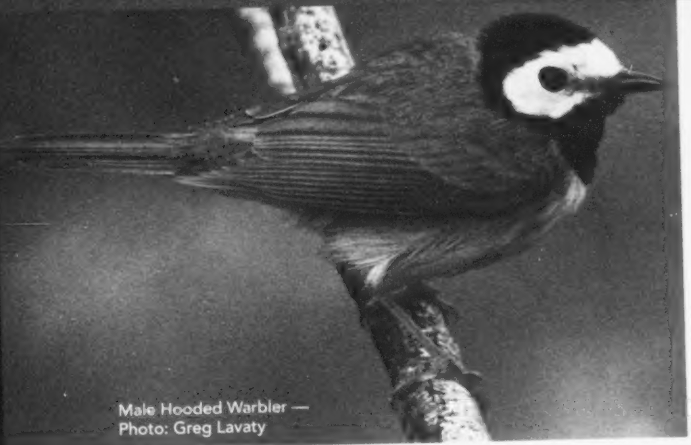
How to Find

The best time to spot the Louisiana Waterthrush is early in spring when their loud musical song can be heard from a long distance away. Look for a bird foraging at the water's edge, bobbing its tail constantly.

Did you know?

- Its habit of wagging its tail is so pronounced that both the genus and species name mean "tail-wagger."
- It is very similar in appearance to the Northern Waterthrush. However, Northerns usually have stripes on their throat, a thinner, buffier white eyestripe that does not extend as far back onto the nape, and more yellowish wash on the underparts.
- This species will sometimes build a walkway of leaves up to the nest.

Hooded Warbler *Wilsonia citrina*



Male Hooded Warbler — Photo: Greg Lavaty

Identification (13–14 centimetres)

This handsome warbler breeds in mature eastern hardwoods with a dense understorey. The Hooded Warbler's loud, emphatic song, "ta-wit ta-wit ta-wit tee-yo" is typically heard before the bird is seen. Males don a jet black hood and throat, which is contrasted by a bright yellow forehead, cheeks, and belly. Their back is olive-green. Females are similar, but vary in the extent of black on the hood and bib. Some have little or no black, while others, particularly old females may have a hood pattern similar to the male (although never as complete).

Conservation Status

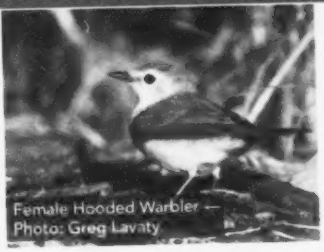
In Canada, the Hooded Warbler is restricted to southern Ontario. Its breeding range extends south through the eastern United States, down to Florida. The Ontario population is designated as Threatened, though its numbers have grown in size and distribution over the last 20 years. The historic breeding range has expanded from Norfolk County to include the Lake Simcoe-Rideau region and southern shield, presumably owing to an influx of migrants from bordering states. Overall, the Hooded Warbler is an area-sensitive species dependent on small-scale disturbance but sensitive to forest loss and fragmentation.

Breeding Biology

The Hooded Warbler is a Neotropical migrant typically found in the interiors of large upland tracts of mature deciduous and mixed forest, and in ravines where small openings in the forest canopy have permitted a dense growth of low understorey shrubs. In Ontario, it breeds from mid-May to mid-August, often producing two broods per season. "Hoodies" nest low in a sapling or shrub (often raspberry) in small bulky cup nests frequently wrapped in dead leaves. Nests contain three to five white eggs speckled with brown and are readily parasitized by cowbirds.

Diet

Hooded Warblers feed primarily on caterpillars, moths, grasshoppers and flies by hawking, hovering, and gleaning from the leaf surface. Females, in particular, tend to feed low in the vegetation, while males are apt to forage at heights from 10 to18 metres.



Female Hooded Warbler — Photo: Greg Lavaty

Management Guidelines

Hooded Warblers colonize forest gaps one to five years after creation, and remain as long as suitable shrubby nesting habitat exists. Hence, both single-tree and group selection in large, mature forests will benefit this species by promoting dense understory and shrub growth. Managed mature conifer plantations with canopy gaps containing low, deciduous understory species will also be occupied. Despite their dependence on disturbance, they only require small gaps, and in fact nest more successfully in natural tree fall gaps than those created through intensive forestry. As such, emphasis should be placed on conserving large, mature tracts of forest in an effort to remediate the historical loss and fragmentation in southern Ontario. Since Hooded Warblers are area-sensitive, efforts to enlarge or reconnect existing woodlands will further increase populations and assist in range expansion.

How to find

The best way to spot a Hooded Warbler is to listen for its explosive song and search for the striking male singing mid-canopy from a perch. Also look for flashes of white, since both sexes tail-fan frequently while foraging or moving about their territory.

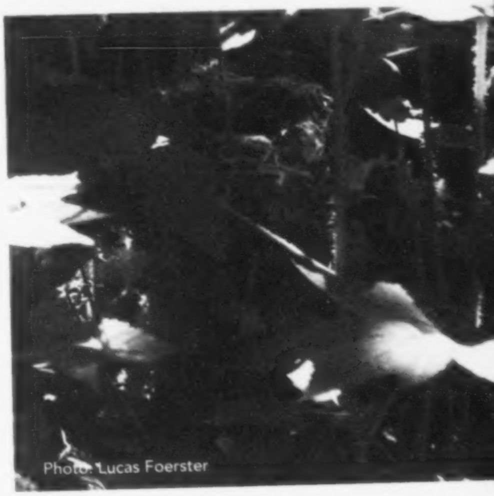


Photo: Lucas Foerster

Did you know?

- Hooded Warblers frequently flick and spread theirs tails while feeding, exposing their large white tail spots.
- They are territorial on their wintering grounds. Males and females use different wintering habitats: males in mature forest, and females in scrubbier forest. If a male is removed, a female in adjacent scrub will not move into the male's territory.

Scarlet Tanager *Piranga olivacea*

Male Scarlet Tanager — Photo: Jeff Nadler

Identification (16–17 centimetres)
The vivid black and red male Scarlet Tanager is one of our most striking birds. Despite this brilliant colouration, it often goes unnoticed because of its unobtrusive, secretive behaviour and preference for the forest canopy. Quite unlike the males, females are olive-green above and dull yellow below with dark wings and tail.

Conservation Status
The Scarlet Tanager is a bird of the forest interior, whose breeding range corresponds closely to the boundaries of the eastern deciduous forest zone, stretching from extreme southern Canada to the northern Gulf States. Long-term continental populations appear to be rather stable, although significant declines have occurred in certain regions, particularly in areas of intensive agriculture.

Breeding Biology
Scarlet Tanagers breed in mature deciduous or mixed forests, preferring those dominated by large trees, often those with white pine present. Females build thin, saucer-shaped nests in the canopy of large diameter trees, often in the fork of a horizontal limb, in a leaf cluster. Nests tend to be shallow, sometimes flimsy, with eggs visible through the bottom. Birds are single-brooded, breeding from late May to early July in Ontario. Clutches consist of three to five eggs that are pale bluish in colour with fine speckles of red or purplish brown.

Diet
During the breeding season, the tanager is mostly insectivorous, eating a wide variety of flying and nonflying insects, various insect larvae, and spiders. When insects are not plentiful, it will take earthworms, buds and berries. It primarily forages among leaves, twigs and branches in the mid-canopy, capturing insects on surfaces of leaves, flowers, fruit, and bark. Scarlet Tanagers often catch flying insects in the air.

Female Scarlet Tanager — Photo: Mark Peck

Management Guidelines
Scarlet Tanagers do best in areas that have low levels of forest fragmentation and larger patches of forest. It fairs poorly in fragmented regions due to poor nest survival and high rates of parasitism by cowbirds. Scarlet Tanagers seem tolerant of a variety of silviculture disturbances in large forest tracts, but prefer mature tracts, particularly those with pine and/or oak. Strategies to maintain habitat for Scarlet Tanagers will hinge on preserving large tracts with large diameter trees. Efforts to reconnect fragments, reduce edge habitat, and maintain pine and oak on the landscape will help conserve local tanager populations.

How to Find
As a bird of the forest interior that spends much of its time in the canopy, your best bet for locating the Scarlet Tanager is to listen for its hoarse, burry song and frequently uttered chip-burrr calls. Where you hear this song, look for a bright red male or greenish-yellow female fluttering about in the canopy.

Photo: Peter Burke

Did you know?

- The male courts females by perching below her, stretching out his neck and spreading his wings to show off his scarlet back
- The female sings a song that is softer, shorter, and less harsh than the male's, often in response to the male's song, or while building a nest.
- The response of the Scarlet Tanager to habitat fragmentation varies from place to place. In the heart of its range in the Northeast, it can be found in small forest patches. In the Midwest, similar sized forest patches are not occupied by tanagers.
- The song of the Scarlet Tanager has been compared to that of a robin with a sore throat.

Northern Cardinal *Cardinalis cardinalis*

Male Northern Cardinal — Photo: Greg Lavaty

Identification (21–23 centimetres)

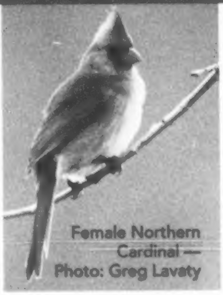
This common bird is a fixture at backyard feeders throughout the winter. Northern Cardinals have a thick, reddish conical bill and a prominent crest. The male is brilliant red all over with a black eye mask and throat, while females are primarily greyish-tan brown with a reduced mask, and dull orange-red tail, crest, and wings.

Conservation Status

The Northern Cardinal is abundant throughout much of eastern and central North America, from southern Canada through parts of the Caribbean. It has expanded its range northward over the last 200 years with the clearing of mature forests, human habitation, warming climate, and provisioning at bird feeders. Breeding Bird Survey data indicate that Ontario populations have grown 3.6 percent annually since 1968.

Breeding Biology

The Northern Cardinal is a resident throughout its range in areas with shrubs and/or small trees. Nests are bulky cups of twigs, stems, leaves, and bark strips built in dense shrubs, trees, or vine tangles. Breeding may begin while there is still snow on the ground. Females lay two to three green to grayish-white eggs with purplish-brown spots, and raise up to three broods per season.



Female Northern Cardinal — Photo: Greg Lavaty

Diet

The cardinal consumes about 30 percent insects and 70 percent fruits, buds, nuts, and seeds. Common plants include the fruits and seeds of wild grape, smartweed, dogwood, sedge, mulberry, sumac, vervain, and tulip tree. Common animal matter foods include spiders, centipedes, flies, ants, snails, butterflies, moths, grasshoppers, katydids, cicadas, crickets, mayflies, and beetles.

Management Guidelines

The Northern Cardinal is abundant and does not require any special habitat management efforts to ensure its survival. It responds positively to forestry practices that increase shrub cover, including group selection and shelterwood cuts.

How to Find

It is not hard to find a Northern Cardinal, just take a look in your backyard! This species is a common urban resident and birdfeeder visitor, and sings a loud array of upward and downward slurred whistles.

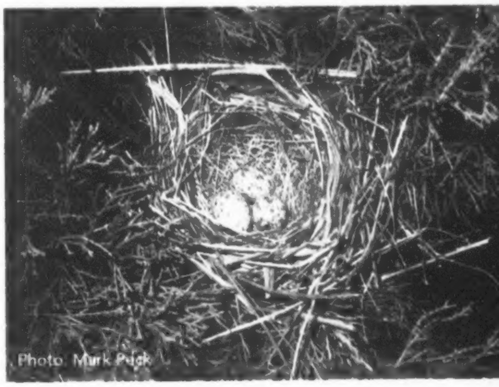


Photo: Mark Peck

Did you know?

- Plumage colour is linked to diet quality. Brighter individuals are considered higher-quality mates and provide more parental care than dull males.
- Female cardinals sing, often from the nest. Their songs are longer and more complex than that of males, and are believed to be a signal to the male to bring food.
- The first record of the Northern Cardinal in Ontario was from Chatham in 1849. The first record in London was in 1915. Its population and breeding range have increased dramatically since then.
- Northern Cardinals may remain with their mates on the breeding territory throughout the winter.
- The male cardinal fiercely defends its breeding territory from other males. When a male sees its reflection in glass surfaces, it frequently will spend hours fighting the imaginary intruder.

Rose-breasted Grosbeak *Pheucticus ludovicianus*

Male Rose-breasted Grosbeak — Photo: Robert McCaw

Female Rose-breasted Grosbeak — Photo: Greg Lavaty

Identification (18–21 centimetres)

The Rose-breasted Grosbeak is known across much of eastern and central North America for its beautiful, bold colours, thick pale bill, and rich musical song. The male has a black head, back, and wings against a white belly and bright red chest. The female is streaked brown above with a bold buffy eyestripe, and brown and white streaked belly.

Conservation Status

The Rose-breasted Grosbeak breeds from the Maritime Provinces and north Atlantic states, west to the Great Plains, and northwest to northeast British Columbia and the southern tip of the Northwest Territories. It is still considered common throughout much of its range, though it has experienced population declines at a level of four percent since the 1980s.

Breeding Biology

The Rose-breasted Grosbeak occurs in a range of primary and secondary deciduous and mixed forest, including shrubby thickets, forest edges, and even well vegetated suburban gardens and parks. It is considered disturbance-tolerant and readily nests within six metres off the ground in areas of dense understorey and sapling growth where the canopy is relatively open. However, nests also regularly occur higher in the canopy of large deciduous or coniferous trees, and these tend to be more successful. In Ontario, this species breeds between early May and late June, raising one brood per season. Nests are quite bulky and flimsy in appearance and made of twigs and stems. Rose-breasted Grosbeaks lay three to four pale blue-green eggs with reddish-brown speckling.

Diet

The diet of the Rose-breasted Grosbeak is diverse, consisting of insects, seeds, fruit, tree flowers and buds. It typically feeds by gleaning insects from leaves in the canopy but later in the summer it can be found foraging in the understorey for ripe berries.

Management Guidelines

Although this species can successfully breed in small woodlands, success tends to be lower and unsustainable compared to larger tracts. Managed forests may attract large densities of grosbeaks, but nest success is highest within mature forests where nest placement in the canopy is more frequent. Despite its occurrence in areas of low basal area, retaining areas of uncut forest may provide the best opportunities for grosbeak nest success in managed forests.

How to Find

Listen for the Grosbeak's song, which is similar to the American Robin's, yet more energetic, richer, and more rapidly delivered. Typically, they sing from the uppermost branches of a canopy tree. Also listen for their distinctive loud "pink" call note, which is similar to the sound a running shoe makes rubbing against a gym floor. Males can be easily spotted early in spring when they are having territorial disputes with younger males. Look for the bold flashes of black and white, anywhere between the understorey and canopy.

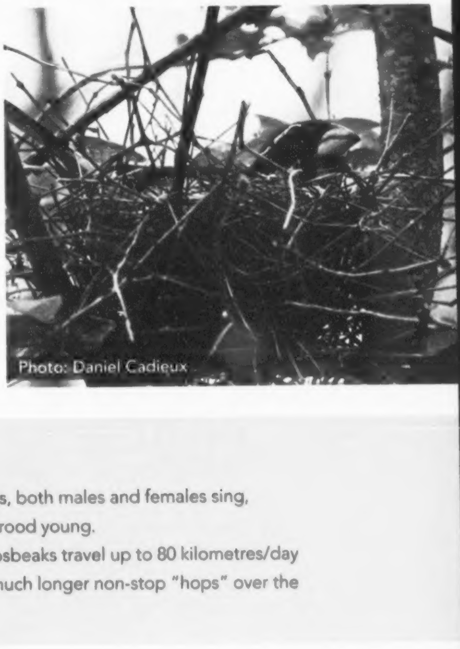


Photo: Daniel Cadieux

Did you know?

- Unlike most songbirds, both males and females sing, incubate eggs, and brood young.
- During migration, grosbeaks travel up to 80 kilometres/day overland, but make much longer non-stop "hops" over the Gulf of Mexico.

Indigo Bunting *Passerina cyanea*

Male Indigo Bunting — Photo: Garth McElroy

Identification (12–13 centimetres)

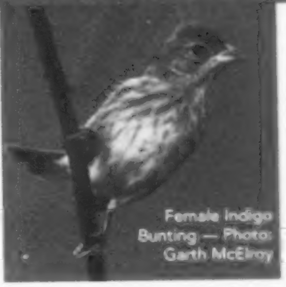
The brilliant blue male Indigo Bunting is easily spotted along roadside edges and scrubby areas. In contrast, the plain brown female is often overlooked, though some may have blue-tinged feathers on wing, tail, or rump. Indigo buntings have short, thick bills and are renowned for their constant singing, from the time the male arrives on territory until the second brood is out of the nest.

Conservation Status

The Indigo Bunting is considered abundant throughout its range. Populations as a whole appear stable or slightly increasing. Local fluctuations occur based on habitat availability; increasing where forests are cut and brush habitat becomes available, and decreasing in areas of forest maturation.

Breeding Biology

The Indigo Bunting breeds from southern Manitoba to Maine, southward to northern Florida and westward to southern Arizona. It breeds in dense shrubby areas like forest edges, roadsides, along railway and power lines, and within forests in openings with dense understorey and relatively open canopy cover. The nest is constructed of leaves, stems, bark strips, and grasses and is placed within one metre of the ground in dense shrubs or herbs. In Ontario, buntings breed between late May and mid August, laying three or four white eggs lightly speckled with brown, and may successfully raise two broods per season.



Female Indigo Bunting — Photo: Garth McElroy

Diet

The Indigo Bunting consumes small insects, spiders, seeds, buds, and berries. It forages on the ground and among shrubs, grasses, and herbs. It also gleans insects from the vegetation, up to the canopy.

Management Guidelines

The Indigo Bunting is abundant in eastern North America and does not require any special habitat management efforts to ensure its survival. Generally, even-aged management and group selection provide the early successional habitat with increased growth of shrubs and understorey herbs that buntings favour. Locally, their populations decline with removal of hedgerows, maturation of forests, and increasing urbanization.

How to Find

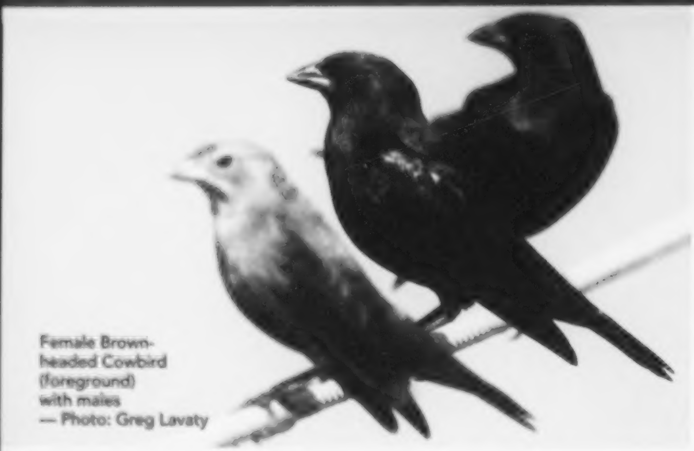
Watch for the bright blue male Indigo Bunting along forest and roadside edges and listen for his lively musical and metallic song.

Photo: Lucas Foerster

Did you know?

- The male and female form a very loose pair bond and hardly interact after egg-laying.
- The male Indigo Bunting does not provide parental care to nestlings and may not help feed the young once they leave the nest.
- Up to four females may nest within a single male's territory.

Brown-headed Cowbird *Molothrus ater*



Female Brown-headed Cowbird (foreground) with males — Photo: Greg Lavaty

Identification (17–22 centimetres)

Originally a bison-following bird of the Great Plains, the Brown-headed Cowbird spread eastward in the 1800s as forests were cleared. Notorious as a brood parasite that lays its eggs exclusively in other birds' nests, it never raises its own young. It is a medium-sized songbird with a stout pointy bill and dark eyes. Males are shiny black with a brown head and neck, while females are dull grey-brown with faint streaking.

Conservation Status

The Brown-headed Cowbird breeds throughout southern Canada and across the United States. It is often seen near short-grass fields and lawns. Though previously restricted to the short-grass plains, its range expanded widely as European settlement opened forests and created large regions of agricultural and suburban habitat. In Ontario, the distribution of the cowbird is limited by the northern edge of the Canadian Shield. Populations have decreased continentally in recent decades due to the abandonment of farms, urbanization, agricultural intensification, and blackbird control programs. In particular, the disappearance of pastureland over the past 25 years has been implicated in the decline of the cowbird in Ontario.

Breeding Biology

The Brown-headed Cowbird is a brood parasite that depends on hosts to care for and raise its young. Females are prolific breeders, laying up to 40 eggs each breeding season. Though 89 host species have been documented in Ontario, Cowbirds seem to have a preference for shrub and tree nesters with eggs smaller than their own. Frequent host species include the Red-eyed Vireo, Yellow Warbler, Northern Cardinal, and Song Sparrow. Females tend to exploit forest-field edges, where they typically remove one to two eggs from the nests they parasitize. Once hatched, the cowbird young are reared alongside the hosts, but tend to be larger, more aggressive and faster growing. Because of this unfair advantage, the cowbird may be the only nestling to survive, often suffocating, starving, or ejecting the weaker host young out of the nest. Because parasitism rates may be as high as 50 percent, the pressure on some host populations can be substantial. See pages 16 and 25 for additional photos of Brown-headed Cowbirds.

Diet

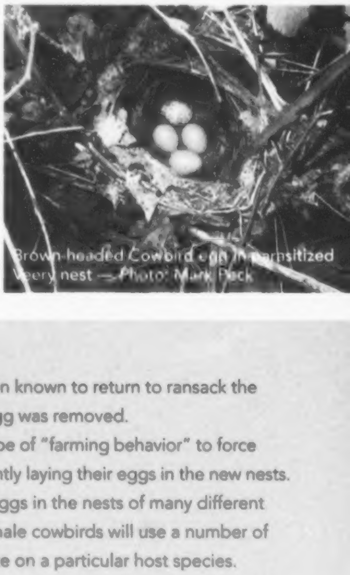
Brown-headed Cowbirds depend on open fields, crop and pasture lands for foraging. They feed primarily on weed seeds (grasses and crop grains) and insects (primarily grasshoppers and beetles).

Management Guidelines

In Ontario, reduction of large, contiguous tracts of forest to small, isolated fragments has benefited the Brown-headed Cowbird at the detriment of a large suite of host species that have had no historical exposure to cowbirds. These species have not evolved mechanisms for rejecting cowbird eggs and are particularly vulnerable to parasitism. As edge specialists, cowbirds respond favourably to all types of forest harvest. Intensive harvesting, such as diameter-limit cuts, particularly result in higher densities of cowbirds. By maintaining higher tree densities (basal area) post-harvest and creating fewer edge habitats, the frequency and intensity of parasitism will decline. As such, efforts should be made not only to follow silviculture standards but to conserve, expand and preserve large, mature forest tracts to benefit host species with small populations.

How to find

You can spot cowbirds most easily when small groups of males gather to court a single female. Listen for the gurgling sounds of the birds while displaying.



rown-headed Cowbird egg in parasitized
eery nest — Photo: Mark Peck

Did you know?

- Brown-headed Cowbirds have been known to return to ransack the nests of host species when their egg was removed.
- Cowbirds also destroy nests as a type of "farming behavior" to force hosts to build new ones, subsequently laying their eggs in the new nests.
- The Brown-headed Cowbird lays eggs in the nests of many different species of birds. Though some female cowbirds will use a number of different hosts, they often specialize on a particular host species.
- Some species, like the American Robin and Blue Jay, are cowbird egg "ejectors." These species can recognize foreign eggs and usually throw any cowbird eggs out of their nest.
- Few species can escape Brown-headed Cowbird parasitism, since commutes between feeding and breeding areas often range from two to seven kilometres and up to 15 kilometres.
- Fledgling cowbirds eventually leave the host parents and find groups of adult and other juvenile Brown-headed Cowbirds by mid-late July. These flocks can be easily spotted in agricultural fields in late summer.

List of Photographers

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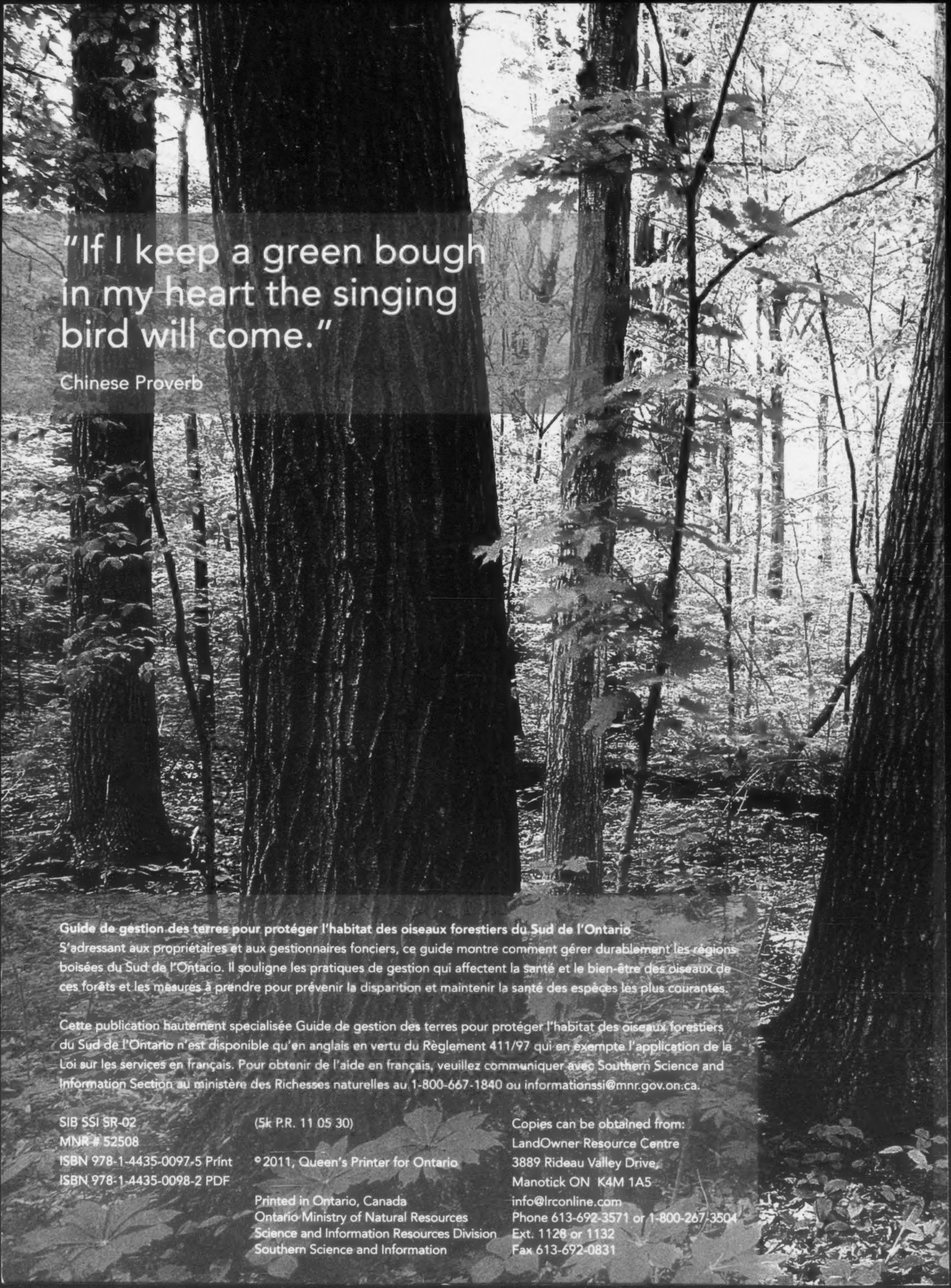

> "If I keep a green bough in my heart the singing bird will come."
>
> Chinese Proverb

Guide de gestion des terres pour protéger l'habitat des oiseaux forestiers du Sud de l'Ontario
S'adressant aux propriétaires et aux gestionnaires fonciers, ce guide montre comment gérer durablement les régions boisées du Sud de l'Ontario. Il souligne les pratiques de gestion qui affectent la santé et le bien-être des oiseaux de ces forêts et les mesures à prendre pour prévenir la disparition et maintenir la santé des espèces les plus courantes.

Cette publication hautement specialisée Guide de gestion des terres pour protéger l'habitat des oiseaux forestiers du Sud de l'Ontario n'est disponible qu'en anglais en vertu du Règlement 411/97 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec Southern Science and Information Section au ministère des Richesses naturelles au 1-800-667-1840 ou informationssi@mnr.gov.on.ca.

SIB SSI SR-02
MNR # 52508
ISBN 978-1-4435-0097-5 Print
ISBN 978-1-4435-0098-2 PDF

(5k P.R. 11 05 30)

© 2011, Queen's Printer for Ontario

Printed in Ontario, Canada
Ontario Ministry of Natural Resources
Science and Information Resources Division
Southern Science and Information

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